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EVOLUTION OF THE SPEECH ORGANS OF MAN

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Human speech depends primarily on the production of sound in the larynx, an organ which corresponds to the reed in various musical instruments or to the sound box of a gramophone. To produce this sound bellows are required to blow air through the glottis; these bellows are provided by the lungs, encased in the thoracic cavity, made up of the mobile ribs and the diaphragm.

The compound sound produced in the larynx is modified by resonators above and below the glottis and is further altered by various stops, which can interrupt the vibrating column of air or direct it mostly through the nose or out of the mouth, independently or synchronously.

These stops are the vocal cords and ventricular bands, the soft palate and nasopharyngeal sphincter, the tongue and fauces and the lips. All of these constituents of the speech mechanism are controlled and coordinated by the brain and are called into action according to necessity. Without intelligent control they would not produce more than instinctive cries and calls. On the other hand, their possession allows human beings to convey complicated messages by means of speech and thereby to advance in intelligence by mutual interexchange of ideas.

There is no doubt that in the evolution of the race intelligence progressed in advance of speech, but once the necessity for intercommunication arose, the human being found himself provided with a mechanism eminently adapted for vocalization. The same progression is seen in the change from infancy to childhood, when intelligence is far ahead of conversational power. It is probable that much, if not all, of the anatomic mechanism was evolved primarily for purposes other than speech, and it will be the purpose of this paper to sift and discuss that probability.

It must be remembered that the mouth and pharynx and the nasal olfactory organ were evolved in fish before a pulmonary system came into existence and that they have maintained their primary purpose throughout the animal kingdom (fig. 1).

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The acquisition of lungs, with a valve or larynx to guard them, has allowed a fresh and efficient means of intercommunication to be brought into use, but this new function has not materially altered the structures designed for deglutition. The nose has altered considerably; after an original separation from the food tract in fish it acquired communication with the oral cavity for purposes of olfaction, as seen in Dipnoi, or lungfish. This alternative exit for sound waves has been made use of by many mammals.

It is necessary, as the foregoing preamble indicates, to be cautious in assessing the relative value of the primitive functions performed by any organ as compared with those secondarily imposed on it.

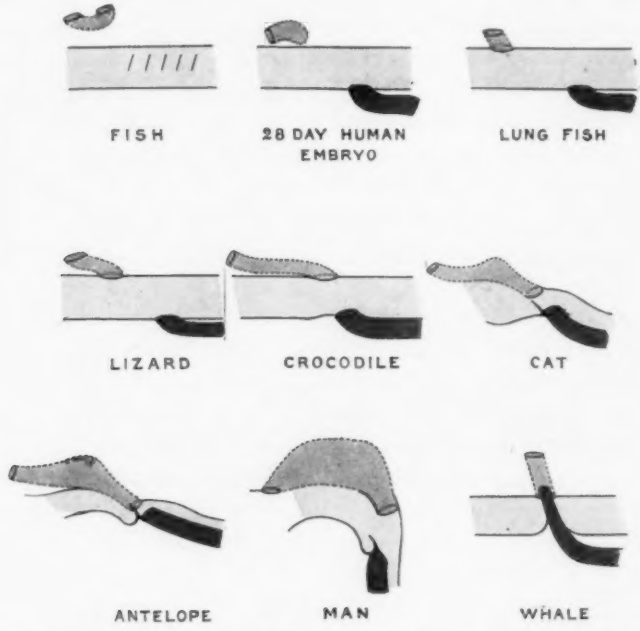

Fig. 1.—Communication between the olfactory organ and the food tract. The pure olfactory organ of a fish does not communicate with the mouth, nor does that of the early human embryo. In lungfish and reptiles there is direct communication between the posterior choanae and the food tract but no direct continuity with the larynx. Keen-scented animals have an intranarial epiglottis, but in man the close contact is lost. Cetaceans have a permanent intranarial larynx for combined purposes of deglutition and respiration.

THE AIR CURRENT

The pulmonary system provides a convenient means of communication, and man profits in this respect, as do some amphibians, many birds and the majority of mammals. It is not the purpose of this paper to inquire into all the various ways in which animals communicate with

other members of their own or other species. It is sufficient to emphasize the advantages of vocal communication when the pulmonary system is available. The sounds emitted are capable of wide variation in pitch, quality and intensity, and they can be produced without interruption of other bodily functions; they can travel against the wind and across obstacles and are intelligible in the dark, thus offering considerable advantages over other methods, such as gesture.

The lungs of man are well adapted to phonation; they are of sufficient capacity to allow sentences to be delivered; the expulsion of air from them is strong enough to produce sounds of ample volume, although not so loud as those produced by many animals. The control of air is

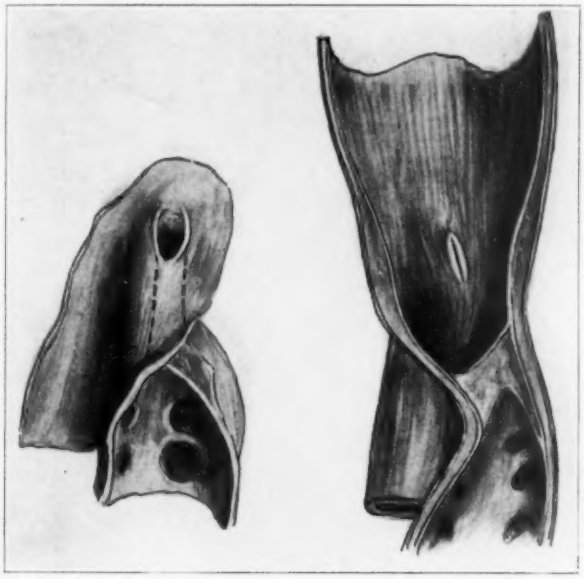

Fig. 2.—Larynx of the lungfish (Ceratodus) in its closed and open phases. There are no cartilages corresponding to the arytenoids, no intrinsic dilator muscle and only a simple sphincter. The dotted lines indicate the short trachea leading to the single saclike lung.

delicate, by virtue of the intercostal muscles and the diaphragm; air can escape in a gradual, regular stream at a constant pressure, or in puffs, thus allowing words to be divided into syllables and sentences into separate words.

SOURCES OF SOUND

Sources of Fundamental Sound.—Animals with a pulmonary system find themselves possessed of a convenient method of phonation in the protective valve of the air tract, viz., the larynx.

If air is expelled from the lungs with the glottis partially closed, the vocal cords are thrown into vibration; the air current is thereby

divided into a series of puffs, and sound is produced. In some lungfish the boundaries of the glottis are of a primitive type, with no cartilaginous framework (fig. 2), but in all reptiles, birds and mammals a rigid scaffolding gives a fixed attachment to the laryngeal muscles. In marsupials, most herbivorous animals and the cat tribe the margins of the glottis are simple, consisting of a layer of mucous membrane covering a bundle of muscle fibers, the thyroarytenoid muscles (fig. 3). If these muscles contract, elasticity is given to the folds bounding the glottis,

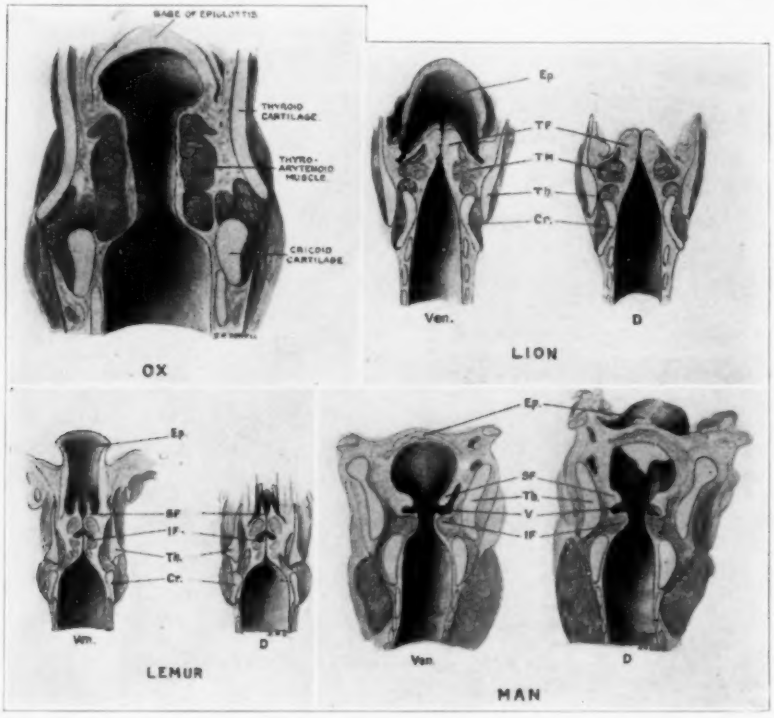

Fig. 3.—Valvular nature of the larynx. Sagittal sections show the nonvalvular nature of the larynx in Herbivora, as exemplified by the ox, and the simple organ of the cat tribe (lion). Division of the thyroarytenoid fold into two divisions is seen in the lemur and in man. In the former both folds are upturned to form a most efficient type of valve; in man the valve is not so well developed. *Ep* indicates the epiglottis, *TF* the thyroarytenoid fold, *TM* the thyroarytenoid muscle, *Th* the thyroid cartilage, *Cr* the cricoid cartilage, *SF* the superior fold, or ventricular band, *IF* the inferior fold, or vocal cord, *V* the ventricle and *Ven* the ventral half and *D* the dorsal half of the larynx.

and when blown apart they tend to recoil in proportion to the degree of contraction. In Herbivora there are high aryepiglottic folds, and the opposed surfaces of the glottis come into contact with one another

during phonation over a wide superficies (fig. 4). Many animals derived from herbivores adopt an arboreal existence and make independent use of the forelimbs; the previously flat and nonvalvular boundaries of the glottis then divide into two parts. The lower projects as a free valvular fold, capable of preventing entrance of air into the lungs when it is desirable to fix the thorax. Man has descended from arboreal ancestors and has inherited a valvular type of larynx. Even when the secondary fold has come into being the primitive mechanism of phonation is not

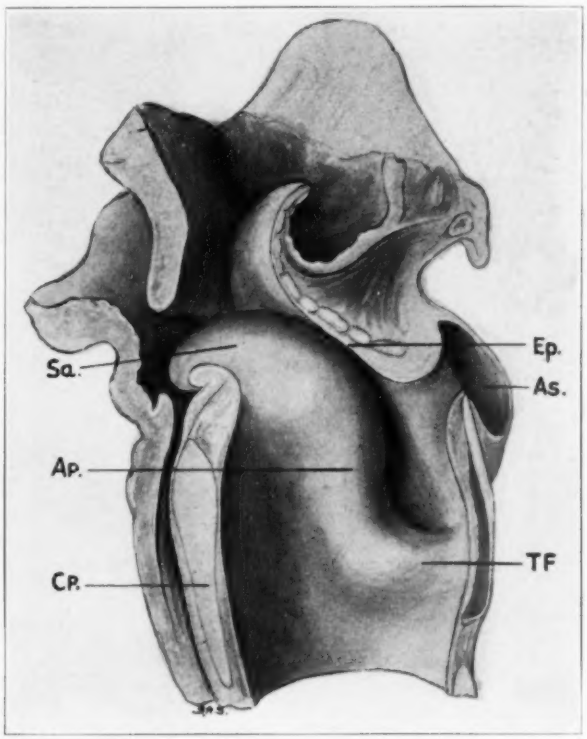

Fig. 4.—Sagittal section of larynx of the reindeer showing the big arytenoid cartilage (*As.*) with the recurved cartilage of Santorini (*Sa.*) surmounting it. The thyroarytenoid fold (*TF*) is flat and nonvalvular. The epiglottis (*Ep.*), the air sac (*As.*) and the cricoid cartilage (*Cp.*) are also illustrated.

altered; rhythmic separation and recoil of the folds, actuated by the expulsion of air from the lungs, produce sounds. There is no doubt that a simple larynx, such as that of the cat tribe, would be sufficient for the needs of man in mere speech; his more highly evolved organ, with its secondary valvular fold (usually called the vocal cord), is of advantage for purposes of song because of its greater flexibility and is of value in allowing modulation of the speaking voice.

The vocal tones of man are of a more mellow quality than those of a gibbon or a chimpanzee, because the vocal cords have less sharp edges (fig. 5); this change to a less efficient type of valve is consequent on the abandonment of a purely arboreal existence, as the complete valvular closure of lemurs, monkeys and apes is not required.

To obtain rapid and even opening and closing during phonation a desideratum is the provision of long membranous folds; cartilaginous margins are too rigid for rapid separation and recoil and allow no more

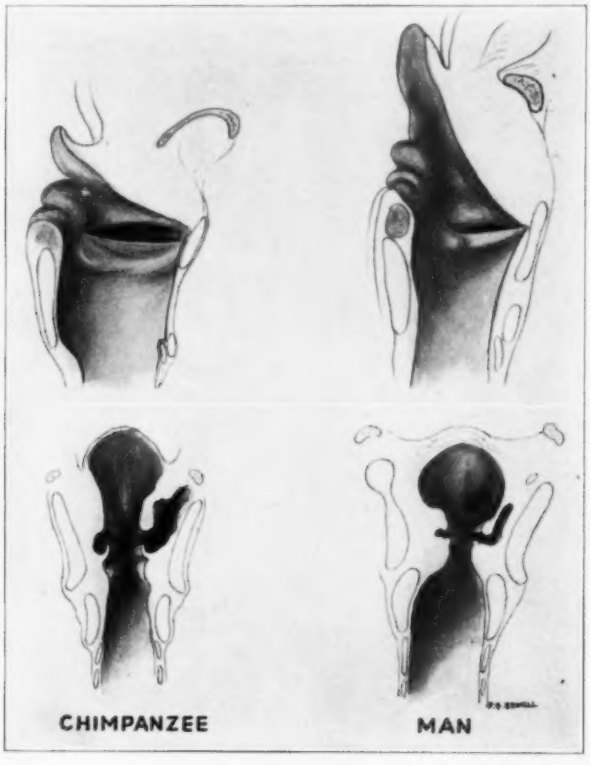

Fig. 5.—Larynx of the chimpanzee and of man. The larynx of the ape is larger and forms a funnel-shaped dilatation at the top of the trachea. The vocal cords are longer and have sharper edges than those of man.

than a hissing sound, such as that heard in birds and reptiles. Man is at a vocal advantage in that his arytenoid cartilages are relatively short, while his membranous folds, or vocal cords, are long. He loses in the power of widely opening the glottis as compared with an antelope or horse, but he gains in phonation. His superior intelligence prevents his relative slowness in the intake of extra air required for running or climbing from militating against his general predominance.

Source of Overtones.—The larynx produces not only a fundamental tone but many overtones. It is by the relative amplification or damping of the overtones that sounds of different character or quality are produced, while others may be added in the resonating cavities themselves. No specific characteristic of the human larynx is directed to the production of this mixed sound; it is common to the vibration of most types of larynx and of reed instruments. If the glottic margins are not closed, air will escape through the constantly open aperture, and a sighing noise, such as that used in whispering, will result. There will then be no fundamental sound of fixed pitch, as in tones.

RESONATORS

The sound produced in the larynx, as such, is but a feeble and colorless effort, as may be noticed in a patient during the operation for removal of the larynx; the sounds of the vocal cords without the superposition of the various resonators resemble those of the sound box of a gramophone without a trumpet.

Resonators of the Tracheobronchial Tree and Lungs.—The registers of the human voice are sometimes divided into head and chest tones, on the assumption that they are chiefly associated with resonance in one or other of these regions. In actual fact all the resonating cavities connected with the airway are in action during all tones produced by either normal or forced resonation.

The cavities below the larynx of man—the trachea, the bronchi, etc.—thus play their part, but no modifications in their structure are especially designed for speech or song. Birds have a peculiar mechanism, in that their voice-producing organ, or syrinx, is placed at the bifurcation of the trachea and in the midst of air sacs. This peculiar anatomic arrangement accounts in considerable part for the vocal abilities of song birds.

The brassy cough associated with aneurysm is produced by the effects of air passing through a compressed bronchus, which then acts like the syrinx of a bird.

Resonators of the Pharynx.—The cavity in immediate relation to the larynx is the pharynx, and it is one of considerable importance. The term pharynx is here used to denote the oropharynx and the laryngopharynx, the nasopharynx being excluded. In man the pharyngeal cavity is large and furthermore is capable of considerable variation in shape, but it must not be assumed that the pharynx has been evolved for vocal purposes; such is not the case, for it is primarily concerned with deglutition. In most mammals the pharynx is small; it lies behind the larynx, which itself is opposite the base of the skull and at the

posterior end of the oral cavity. In the higher apes there is a restricted pharyngeal region intermediate between the esophagus below and the mouth and nasopharynx above; the larynx forms its ventral wall (figs. 6 and 7).

Let me now consider how the pharynx has come into existence and why it is of such large size in man:

The position of the larynx in mammals is determined by the position of the tongue; the former lies close behind the latter. In most mammals the tongue lies flat on the floor of the mouth, which itself is carried forward beyond the cranial cavity into the projecting snout.

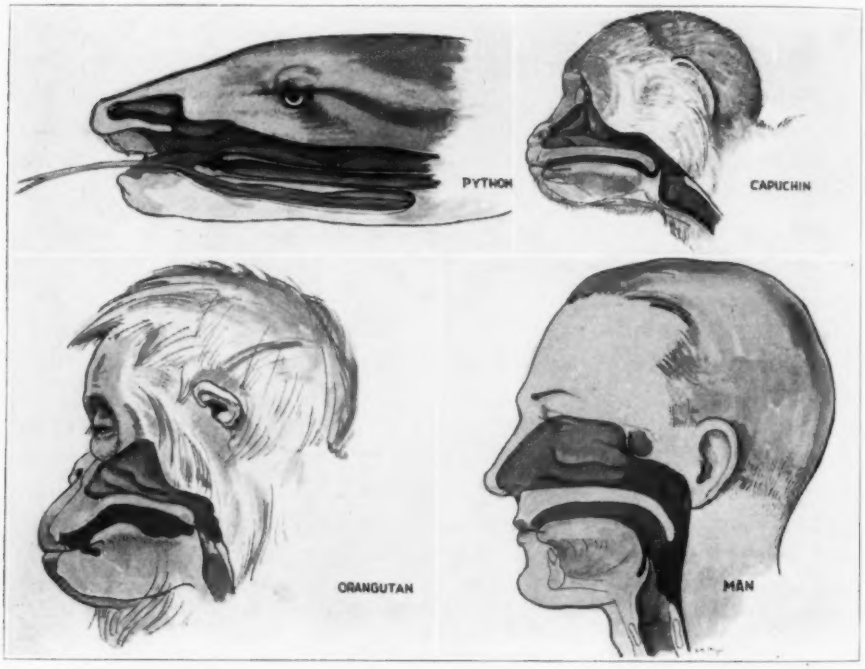

Fig. 6.—Comparative anatomy of the pharynx. Semidiagrammatic representation of the nose, palate, tongue, pharynx and larynx in a snake, a monkey, an ape and a man. The elongation of the palate is well illustrated; it comes into close contact with the larynx in the monkey, but in the higher apes and in man there is a gap of varying size.

For animals which hunt their prey, long, powerful jaws are necessary. Animals which crop herbage also need long projecting jaws. Monkeys and the higher apes live on more substantial food and have a slightly less prominent snout; but in modern man the jaws have receded, and the oral cavity now lies beneath the brain case instead of projecting in front of it.

Comparative studies described by Keith[1] are interesting. The American or European type has a receded snout as compared with the native of Australia, and the snout of the latter is shorter than that of the Neanderthal man whose snout is still shorter than that of the Rhodesian man (fig. 8). In prominence of jaws the Rhodesian man approaches but does not equal the gorilla. Not only have the jaws of modern man receded, but they have contracted and hence the palatal area has

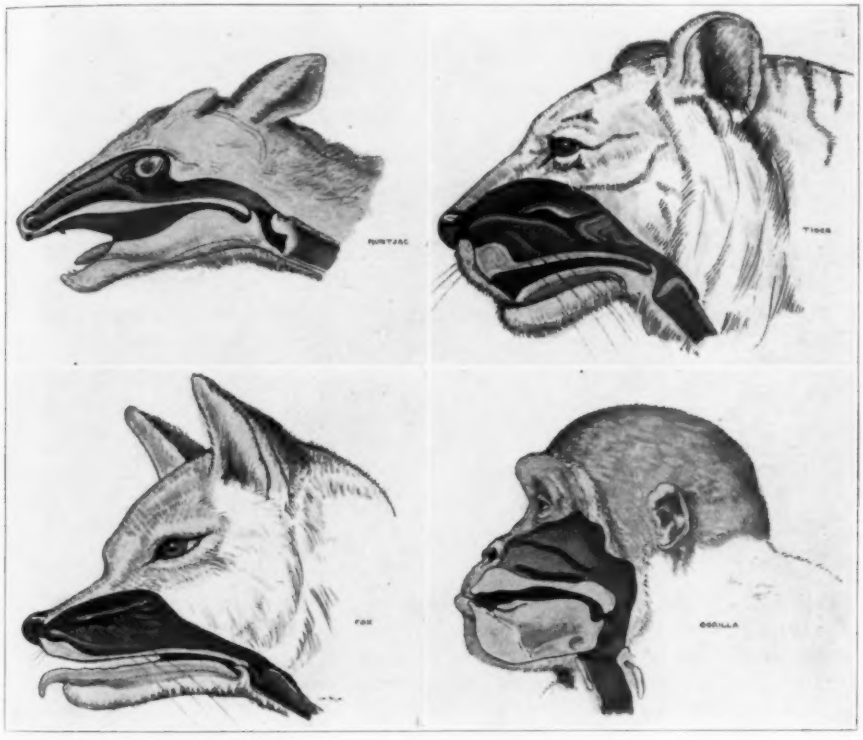

Fig. 7.—Relationship of the palate and the larynx. In keen-scented deer (muntjac) the epiglottis lies above the soft palate and causes all air to enter and leave through the nose during respiration. In Carnivora (tiger) the same arrangement holds good, to preserve the olfactory sense for purposes of tracking prey. In the wolves and the dog tribe (fox) the epiglottis lies in contact with but below the palate. During inspiration air must enter by the nose and thus supply scent to the olfactory organ; the expiratory current can, on the other hand, escape through the mouth, as the epiglottis is blown down. In this way moisture is carried off the tongue to cool the animal; this mechanism is of value, because sweating is impossible. The gorilla relies on sight and not on scent and no longer needs to direct air through the nose; there is, in consequence, a gap between the soft palate and the epiglottis.

1. Keith, A.: The Antiquity of Man, London, Williams & Norgate, 1915.

diminished. The tongue has decreased in size, but not in proportion with the oral cavity, so that it has been forced backward and is now made to lie, not flat, as in earlier types of man, but curved and directed downward into the pharynx, of which it thus forms part of the anterior wall. The larynx has been involved in this backward progress and has been

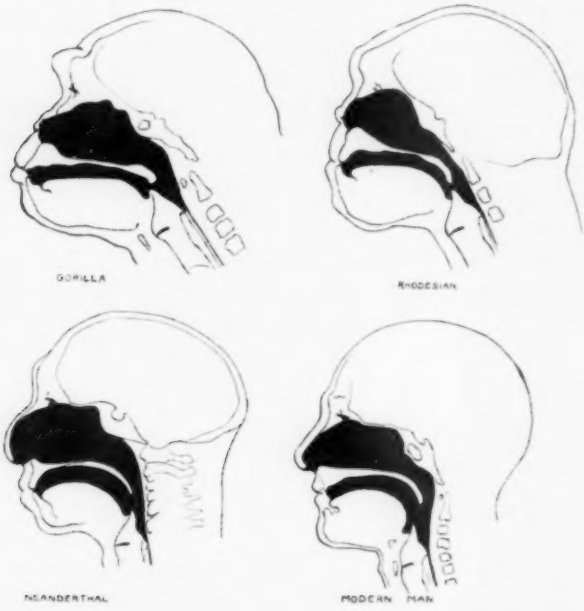

Fig. 8.—Stages in the evolution of man. Diagrammatic representation of the position of the larynx and the position and size of the pharyngeal, oral and nasal resonators in the gorilla and in early and modern man. The diagram of the Rhodesian man is constructed from illustrations in Sir Arthur Keith's book, (The Antiquity of Man, London, Williams & Norgate, 1915). The author's permission was obtained. There was marked prognathism, almost to the degree seen in the gorilla. The palate was long and the tongue flat. The larynx lay high in relation to the vertebral column, although at a slightly lower level than in the ape. The epiglottis was distinctly separated from the soft palate. The larynx was probably large and funnel shaped, as in the higher apes. The diagram of the Neanderthal woman was made for me by Sir Arthur Keith; it is a composite figure made up from a vault from Gibraltar and a mandible and spine from Palestine. The jaws have receded somewhat, and the tongue, in its backward progress, has become slightly curved. The larynx thus lies at a lower level in relation to the base of the skull and the vertebral column than in the apes. There is, however, no large pharyngeal resonator, as in modern man, in whom the jaws have still further receded but the tongue is large; the larynx is thus forced to lie low in the neck. In this way a capacious pharynx comes into existence. The palate of Neanderthal man was slightly larger than that of modern man. The gap between the palate and the epiglottis has increased during evolutionary changes to that of modern man.

forced downward so as to lie, finally, opposite the midcervical vertebrae. Evolutionary stages in this descent are seen reenacted in the growth from embryo to fetus and from infant to child and then to adult in the human being.

Secondary and minor factors are changes in the pituitary angle in man, which cause the face to bend downward in relation to the base of the skull, and in the degree of the occipitovertebral angle.

Separation of the Epiglottis from the Soft Palate.—Another factor comes into play, and that is separation of the epiglottis from contact with the soft palate. In both carnivorous and herbivorous animals close contact of epiglottis with soft palate is necessary to shut off the mouth from the normal air tract and thus to insure abundant passage of air, laden with the scent of prey, of enemies or of food, over the olfactory mucous membrane. Man relies on sight and not on scent and therefore does not require this mechanism; hence there is in him a considerable gap between the palate and the epiglottis. Had he required this exclusion of the mouth it would no doubt have been possible for both soft palate and epiglottis to elongate sufficiently to remain in contact. However, absence of this necessity has given him an inestimable advantage in phonation, as it allows the oropharynx to be used as a resonator, in addition to that area below the level of the epiglottis, the laryngopharynx. The higher apes—gorilla, chimpanzee and orangutan—also show this separation, the epiglottis just failing to come into contact with the palate; but in all of them the pharynx is small.

It is thus that a large cavity capable of acting as a resonator has evolved in man. The primary function of its muscular walls is to propel food downward into the esophagus; but the muscles primarily designed for deglutition can carry out certain movements in the production of speech (fig. 9). Their services are still more obvious during song.

Resonators of the Nasopharynx and Nose.—An olfactory organ is present in all mammals. It is in communication with the respiratory tract and acts either as a direct or as a forced resonator during the production of sound. Certain changes in this region have occurred in man, with a consequent influence on his speech. The nose, although not large, is not crowded with convoluted turbinal bodies, as it is in keen-scented animals like deer or members of the dog tribe. The smooth walls will therefore resound readily. Then, too, the paranasal sinuses are relatively large and may be of minor service for forced resonation. There is also a roomy nasopharynx, a cavity brought into existence by backward growth of the soft palate. The mechanism of partial or complete closure of the nasopharynx during deglutition has been modified for purposes of phonation and is used extensively during speech and song.

During the production of pure vowel sounds and some consonants the nasopharynx is closed temporarily, as in pronunciation of the consonant "k." The middle and the inferior pharyngeal constrictor do not, however, contract forcibly; if they did, a muffled quality would be given to the voice.

Man is in a peculiarly fortunate position as regards the use of his nasal resonators; for, as already mentioned, the larynx is widely separated from the soft palate, and so it is equally easy to emit sounds through the nose, through the mouth and through both cavities simultaneously.

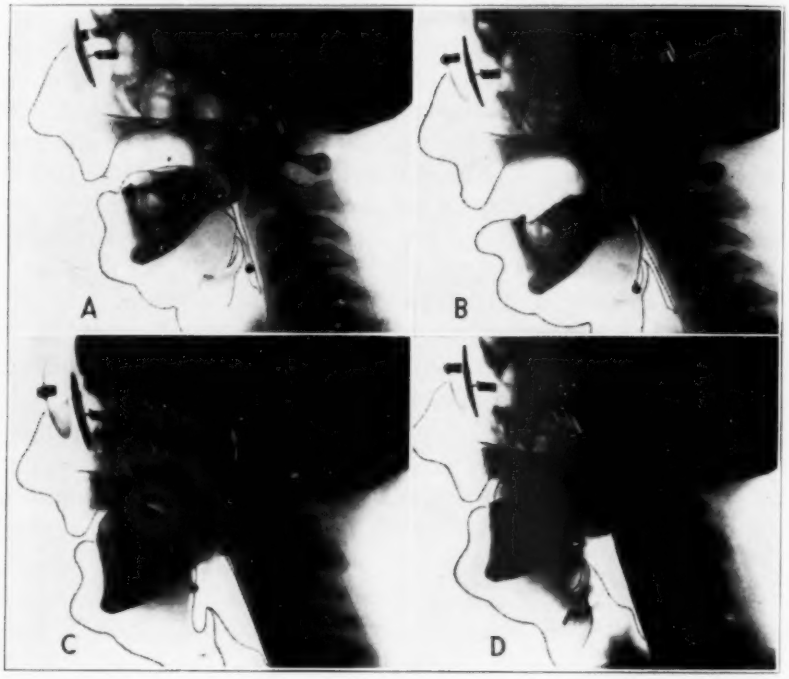

Fig. 9.—Pharyngeal and buccal resonators. Roentgenograms show the relative sizes and shapes of the buccal and pharyngeal resonators during the production of certain voiced sounds. These were taken under the supervision of Dr. H. A. Harris by Mr. F. Melville, of the Institute of Anatomy, University College, London, England. Chains have been inserted through the nose and mouth to show the position of the soft palate and tongue.

For the production of "a" as in "father" (*A*) the tongue is flattened and the oral cavity is open; the epiglottis lies close to the vertebral column, and the pharyngeal cavity is almost obliterated. For "o" as in "bore" (*B*) the oral cavity is wide open, with the tongue flat and drawn backward. The pharynx is small. For "oo" as in "pool" (*C*) the tongue is arched and the pharyngeal cavity wide open. The epiglottis is upstanding, and the laryngeal aperture is brought into line with the axis of the trachea. For "j" as in German "ja" (*D*) the tongue is arched again and the pharynx open. The nasopharynx is closed in all four sounds.

ORAL CAVITY AND TONGUE

The tongue varies considerably in the animal kingdom; it may be used for grasping food, as among chameleons, anteaters and giraffes.

Carnivorous reptiles like crocodilians have a flat and immobile tongue, as they bolt their food; carnivorous mammals have a well formed and mobile tongue, but the organ is seen at its best in herbivores, which use it for grasping herbage. The oral cavity of modern man is not of so great a capacity as that of his ancestors, as shown by comparison with the Neanderthal and the Rhodesian man. It is, however, of considerable use in speech, owing to its variation in size and shape, by virtue of the mobile tongue and the cheeks.

As the oral cavity in man has diminished in size, so the pharynx has become bigger. The large size of the tongue may be a relic from ancestors with a prognathous jaw, but there would seem to be no good reason why it should remain large if its main function were the propulsion of food. It would rather appear that its value for purposes of speech may have led to its retention in an exaggerated size.

The alteration in relative size between the pharynx and the oral cavity is to the vocal advantage of man, as it is possible for double resonance to be effected. This is of considerable use for variations in quality of sound and thus for making possible the recognition of differences between one voice and another.

CHEEKS AND LIPS

The mouth in the lower animals is large and somewhat funnel shaped, but it is deficient as regards lateral walls. The necessities of mastication of herbivorous animals have called for the provision of cheeks to complete the cavity and to prevent the squeezing out of food laterally during chewing (fig. 10).

Cheeks are well developed in monkeys and higher apes and in man, by virtue of his herbivorous ancestry. There are none in fish and only small ones in birds and reptiles.

Mobile lips are seen in all mammals, but in various forms; a reason given for their presence is the necessity of obtaining nourishment by suckling during infancy.

There is a complete absence of movable lips in fishes, birds and reptiles, while in all mammals except monotremes they are present. They are well developed in marsupials, which in late fetal life are attached permanently to the maternal mamma by their lips.

Man makes considerable use of these muscular structures during speech—not to mention osculation—not only for altering the shape of the oral cavity but for the production of labial consonants. Gibbons, chimpanzees and orangutans also utilize the lips to advantage in emitting purposive sounds and cries.

UNVOICED SOUNDS

If air is expired through the glottis when the latter is not fully closed, a sighing sound is produced; this mechanism is used in whispering. If air is blown through the teeth with the lips open, a hiss is emitted; this mechanism is used for the production of sibilants. Birds

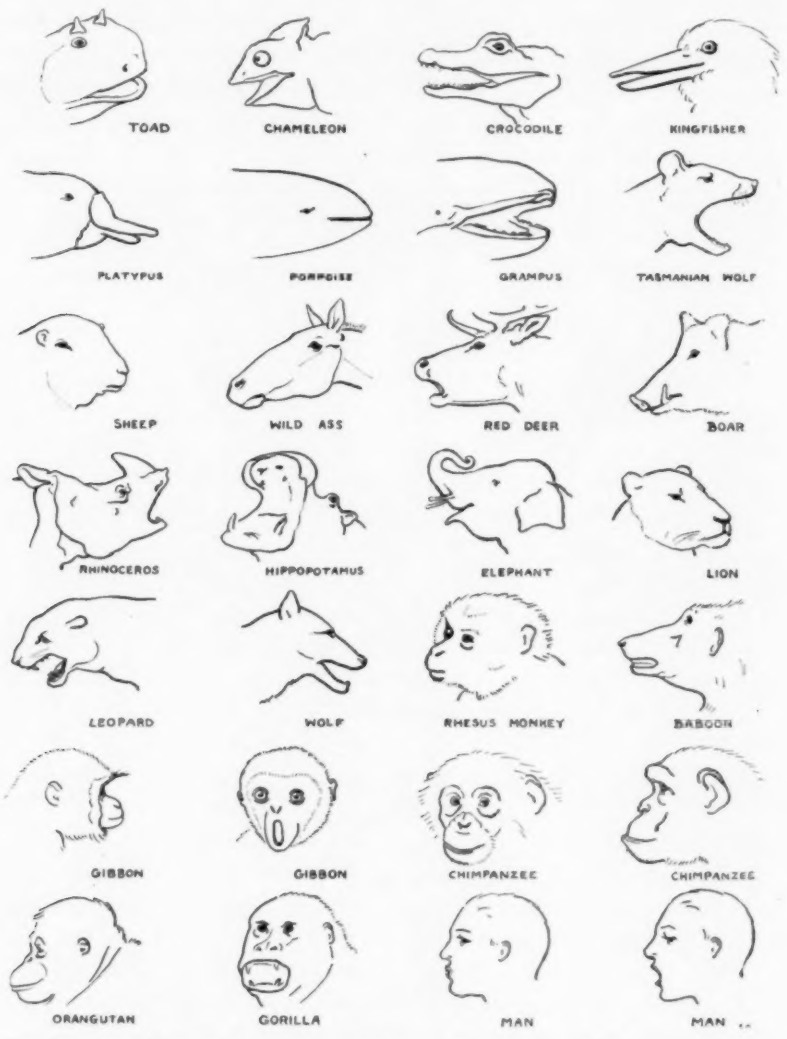

Fig. 10.—Evolution of the cheeks and lips. Various amphibians, reptiles, birds and mammals are shown in outline. Carnivorous animals which bolt their food do not require cheeks; Herbivora, on the other hand, have good protection to the oral cavity to prevent sneezing out of food laterally during mastication. Lips are seen in all mammals and are said to have evolved for purposes of suckling. They act in a prehensile manner in Herbivora, being used for grasping leaves and herbage; in monkeys and apes they are used in eating fruits and berries. Animals with well formed mobile lips make use of these structures for vocal purposes.

and reptiles make use of hissing either as an addition to or in place of voiced sounds.

STOPS

Interruption of the production of sound may be brought about in several ways. The current of air from the lungs may be interrupted by temporary cessation of expiration. The glottis may be closed and then suddenly opened, as in exclamation and in the glottal stop of singing, the coup de glotte. The nasopharynx may be shut off or opened suddenly by movement of the soft palate and the superior constrictor; the junction of the mouth and the pharynx may be closed by the tongue and fauces, and the aperture of the mouth itself may be opened or closed by the lips. All these mechanisms are brought into play in speech, but they were originally evolved for the other purposes I have mentioned.

CONCLUSION

It can thus be seen from a comparative anatomic and physiologic study that man is in an advanced position in respect to his organs of speech. He has the potentiality for producing sounds of varying quality, character and intensity. His anatomic makeup does not permit him to emulate many animals with greater vocal power in proportion to their size, but even so his voice can carry for long distances.

Speech can be adapted to give an infinite variety of inflections and thus assist in expressing ideas. The human voice has also the advantage of helping to identify the speaker, owing to individual variations. Sounds of the pitch desired, with admixture of overtones, are produced in the larynx; in man they are of pleasing quality because of the character of the vocal cords, neither too sharp edged nor with too wide a surface of approximation. The sounds produced in the larynx are amplified and selected in the pharynx, mouth and nose, and in these cavities some of the overtones can be strengthened while others are subdued or suppressed. The relative size and shape of these cavities are subject to considerable voluntary variation. Other sounds can be produced by the action of the nasopharyngeal and the labial stops, and hissing sounds are produced at the teeth.

A point to be emphasized again is that various factors have combined to bring into existence a mechanism well adapted for speech when the intelligence calls for its employment. To think that the larynx and its vocal cords have been evolved primarily for purposes of speech is incorrect. A much simpler organ would have sufficed for the bare vocal needs of man. In this respect it is interesting to note that after removal of the larynx speech may be carried on with success by expulsion of air from the gullet and stomach through the mouth of the esophagus, with no great change from the quality of the voice before operation.

It is only by the exercise of his intelligence that man is able to make full use of the organs with which he is provided. During his evolution his intellect was in advance of his command of speech, but it enabled him to adopt the organs already evolved for other purposes. The stimulus of arboreal existence brought about considerable progress. The ability to converse with his fellow men and to exchange ideas gave in return an increased impetus to the development of his intellectual powers.

THE VOCAL MECHANISM OF EARLY MAN

It will be of interest to turn back for a moment to consideration of the voice of the ancestors of modern man. It may well be supposed that the lungs in primitive man were of greater capacity than those of human beings of the present day and that air could be expelled with considerable force through the glottis. The larynx was then altogether bigger and somewhat funnel shaped; the vocal cords were longer and had sharper edges. The voice, for these reasons, was stronger but more harsh.

The pharynx was small, but the oral cavity was roomy. The nasal cavities were larger but had rather bigger turbinal bodies than those of modern man. The larynx was well separated from the soft palate, and therefore vocal sounds could escape equally by mouth or nose. The cheeks and lips were well formed, and closure of the nasopharynx was efficient. The consonants requiring the use of stops could be executed, and for the production of certain sounds the tongue could be brought into use. The disproportion between oral and pharyngeal cavities allowed of fewer variations in quality of voice than are now possible; distinctions between individual voices would, therefore, have been less pronounced. Although early man was provided with all the necessary requirements for speech as modern man uses it, his intelligence was of too low an order to allow his taking much advantage of his physical possibilities. The members are making up for it at this convention! Please excuse me if I have abused your patience in this attempt to analyze how Homo sapiens became so loquacious.

Sir Arthur Keith advised me about the vocal mechanism of early man and provided me with an illustration of a reconstruction of Neanderthal man. Sir St. Clair Thomson criticized and corrected this paper.

DISEASES OF THE VENTRICLE OF MORGAGNI

WITH SPECIAL REFERENCE TO PYOCELE OF A CONGENITAL AIR SAC OF THE VENTRICLE

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To the average laryngologist the ventricle of the larynx is merely a slit between the true and false vocal cords, as it was to Galen in 300 A. D.

It was Morgagni, in 1741, who described it more fully and after whom it is named. John Hilton[1] in 1837 gave a most accurate and detailed description of a series of fine dissections which he made of this space. It was he who drew attention to the anterior upward projection of the horizontal slit of Morgagni to form the anterior vertical blind pouch, known as the sacculus ventriculi laryngis (fig. 1).

Irwin Moore[2] said:

> This sacculus lies between the ventricular band and the inner surface of the thyroid cartilage. It extends directly upwards from the anterior part of the ventricle and represents the air-sacs which in anthropoid apes are connected with the ventricle.
>
> The sacculus varies greatly in size and shape; sometimes it is nearly conical with its base below, in other cases it is pear-shaped with its broader part above. It averages about half an inch in the vertical direction reaching the upper border of the thyroid cartilage. The thyro-epiglottideus and the ary-epiglottideus muscles as they sweep into the ary-epiglottidean fold surround the upper part of the sacculus and act as the Compressor Sacculi Laryngis of Hilton.

Hilton demonstrated that the sacculus is invested throughout with closely set mucous glands and lies in loose connective and adipose tissue. He expressed the opinion that the muscles mentioned compress the sacculus and discharge the thin secretion it contains to lubricate the vocal cords. He also described two crescentic folds of mucous membrane at the mouth of the sacculus, where it enters the ventricle. He suggested that their purpose is to break the stream of fluid from the sac and give it a general diffusion over the surface of the vocal cords.

Physiologically the sacculus may be considered the oil can of the vocal cords. During phonation or deglutition the sphincters (adductors) of the larynx are put in action. Thus, when the vocal cords vibrate

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1. Hilton, J.: Description of the Sacculus or Pouch in the Human Larynx, Guy's Hosp. Rep. **2**:519, 1837.

2. Moore, I.: The So-Called Prolapse of the Laryngeal Ventricle and Eversion of the Sacculus, J. Laryng. & Otol. **37**:265, 333 and 381, 1922.

against each other and need lubrication most, the compressor sacculi is set in motion and squirts out the necessary lubricant. This may account for the fact that when the vocal cords are used wrongly, as by shouting, singing or talking too long or too loudly, the normal mucous secretion is inadequate to keep up with that which is used by the rapidly vibrating vocal cords, and the voice cracks. The performer, reflexly, gulps rapidly or drinks water. Neither the saliva nor the water reaches the vocal cords, but during the act of swallowing the whole larynx is pulled up and back behind the hyoid bone by means of the thyrohyoid and superior constrictor muscles of the pharynx. At the same time the tongue, together with the epiglottis, is forced back against the closed glottic chink, which comes to meet it. The constrictors of the larynx come into play, including the thyroarytenoid muscle, which sets the

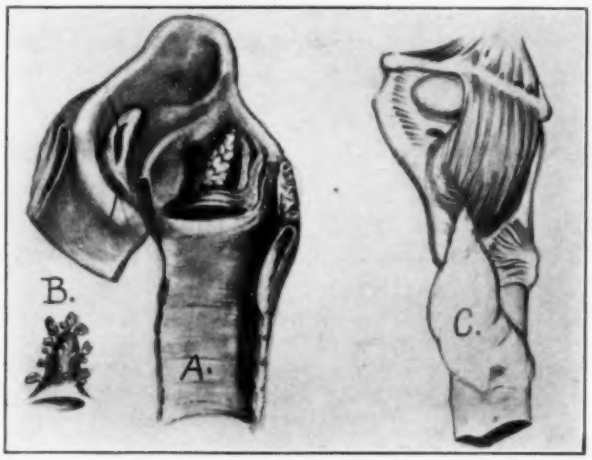

Fig. 1.—*A*, interior of the larynx, showing the sacculus laryngis on the right side exposed by the removal of the mucosa with its glands resting on it, and on the left side cut open and a bristle passed through the natural opening of the ventricle. (From a dissection by John Hilton). *B*, the sacculus laryngis with the glands and their ducts raised from the pouch. The sketch shows their general character rather than the actual size or relative position. *C*, the larynx, showing an extralaryngeal ventricular sac on the right side lying partially outside on the thyroid membrane (Gruber, W.: Kehlkopf mit theilweise ausserhalb desselben seitlich gelagertem rechtem Ventrikelsacke, Virchows Arch. f. path. Anat. **78**:106, 1879).

compressor sacculi to work and stimulates it to squeeze out the last drop of valuable mucus to lubricate and cool off the overexcited vocal cords.

When one examines such a larynx one finds the vocal cords to be red and dry, in contradistinction to those of a well trained singer or speaker, which are pinkish white and have a frothy, sticky filament of mucus between them.

The normal structure of the larynx is important and accounts for the origin and location of the various pathologic conditions that may occur. The true cord, the free margins of the ventricular band and the posterior surface of the epiglottis are covered with stratified squamous epithelium. The rest of the larynx, especially the pouch of Morgagni and its upward extension, the sacculus, is covered with stratified columnar epithelium. The lymphoid cells, singly and in islands, are scattered in the stroma. In the submucosa of the ventricle and sacculus are found many tubular glands lined with mucous and serous cells. The openings of these glands empty their contents into the ventricle. The glands are embedded in fat and surrounded by the thin muscle fasciculi of the thyroepiglottideus and aryepiglottideus muscles. In contradistinction, in the region of the true vocal cords there are practically no glands, and the whole submucosa consists of muscle (thryoarytenoid), the inner fibers of which are closely incorporated with a fibroelastic band of tissue covered with stratified squamous epithelium (fig. 2).

The ventricle and sacculus are blind, stagnant recesses which are surrounded by a mucosa rich in mucous glands and lymphoid tissue. It is therefore probable that many pathologic conditions of the larynx which were considered as arising from the true vocal cords, such as cancer, tuberculosis, benign papilloma or cysts, really originate from the ventricle and encroach on the vocal cord.

Quick,[3] though he did not specifically mention this point, displayed several excellent illustrations showing cancer arising from the ventricle and "spilling over." Figure 2 *X* shows a tubercle on the inner surface of the false vocal cord, extending into the ventricle, associated with early tuberculosis of the ventricle.

It is well known how deceptive may be the size and extent of a tumor of the vocal cord when viewed indirectly by the laryngeal mirror as compared with its actual appearance at the time of operation. Some of the less grave diseases of the larynx, such as laryngitis, nodules of the vocal cord, pachydermia and even contact ulcers of the vocal cords, when not due to descending infection of the upper respiratory tract or other recognizable irritant, may be due to lack of secretion or perverted secretion of the glands that empty into the sacculus and ventricle. The valve of Hilton may be congenitally small, or it may be occluded by a plug of mucus. This may account for the remarkable relief often obtained in the treatment of certain types of laryngitis when the supraglottic region is irrigated with physiologic solution of sodium chloride by means of a laryngeal syringe.

3. Quick, D.: Carcinoma of the Larynx, Am. J. Roentgenol. **38**:821, 1937.

Negus,[4] in his monumental work, "Mechanism of the Larynx," proved conclusively that the human larynx is not purposely designed as an organ of speech. "You cannot," he declared, "tell by an examination of the larynx, whether the owner could speak or not. You cannot tell by anatomical means, the larynx of a prima-donna from that of a woman who had the voice of a raven." The ape has in its larynx all the structures needed for speech. What is lacking is the ability to use them. Speech is a faculty of the brain.

The larynx is a valve situated at the entrance of the pulmonary system, with the primitive function of preventing anything but air from

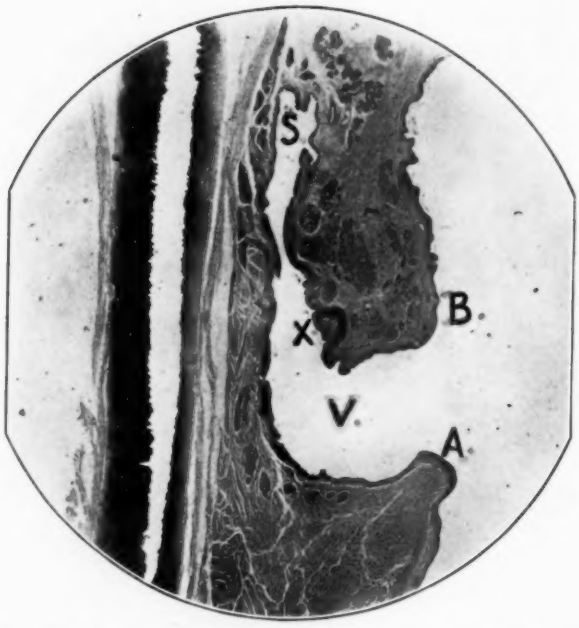

Fig. 2.—Coronal section of the larynx in the region of the ventricle. *A*, true vocal cord; *B*, false vocal cord, with a great number of mucous glands scattered through its stroma; *V*, the ventricle; *S*, sacculus laryngis; *X*, small tubercle on the inner surface of the false cord in early tuberculosis of the larynx.

entering the lungs. This is accomplished in all animals by the sphincter action of the thyroarytenoid muscles (adductors). The dilators, which occur only later, with evolution, open this valve—the cricoarytenoid muscles (abductors).

Embryologically the lungs arise as an outgrowth from the ventral surface of the foregut. The primitive sagittal cleft connecting the two becomes the adult larynx.

4. Negus, V. E.: The Mechanism of the Larynx, London, William Heinemann, 1929.

In the Dipnoi, or lung fishes, the larynx is in its simplest form, a small fissure with upturned lips parallel to the axis of the pharynx, on the floor of the pharynx. It is destitute of cartilage. On each side of the fissure run strands of muscle fibers arranged in a sphincteric fashion. Their contraction closes the fissure and their relaxation allows it to open. There are no dilators present.

In Ceratodus, another member of the Dipnoi, dilator muscles are present to open the aperture of the larynx. To insure patency of the air tube, a cartilaginous scaffolding appears in amphibians, reptiles and mammals: first the cricoid cartilage, then the arytenoid cartilage and finally the thyroid cartilage.

The larynx of mammals does not differ basically from that of reptiles and birds. There are a cricoid ring, a thyroid cartilage and an arytenoid cartilage. The sphincteric girdle arises from both thyroid and cricoid elements, to be inserted into the arytenoid cartilages. There are paired dilators arising from the cricoid and inserted into these arytenoid cartilages.

In tracing the development of the larynx phylogenetically, Negus [4] has drawn a convincing panorama of the modifications that have taken place in this organ in the various species in order to adapt it to the requirements of each. He has enunciated some revolutionary ideas: that the epiglottis is an organ of olfaction and is best developed in those animals which depend on the sense of smell to obtain their food (i. e., the dog), and that the structure and position of the larynx depend on the environment (water or land) and the nature of the food of the animal. Thus, a snake, when it swallows a rabbit would choke to death were it not for the fact that while the snake is ingesting the rabbit the larynx comes forward into the floor of the mouth, close to the front of the lower jaw.

The structure of the larynx in different mammals is dependent on the relative quantity of oxygen required and of carbon dioxide given off by the lungs. This, in turn, is dependent on the mode of life. Thus, the horse and the deer, which are fast-running animals, require a rapid exchange of the gases. Hence the larynx presents a wide glottic chink with long arytenoid cartilages to give ample space and rigidity for this purpose.

In the anthropoid ape and in some other mammals another important factor appears—the muscular action of the forelimbs in grasping, striking, climbing and hugging. To give the pectoral muscles their fullest play the bony structure of the thorax must be fixed. This means a temporary cessation of respiration. To overcome the temporary lapse of a vital function, air sacs arising from the ventricles of the larynx have been evolved. These are filled with oxygen and during expiration

with carbon dioxide. They act as mixing chambers and are used with the least amount of exertion by the lungs when the animal is actively engaged in using its forelimbs and normal respiration stops (fig. 3). In various other animals it will readily be seen how useful these air sacs are while the animal is under water.

Air sacs for rebreathing are located in different places above the inlet valve (larynx) of the respiratory system; i. e., they may be buccal (as in the frog), subhyoid or subthyroid. Those of present interest, however, are the laryngeal air sacs of the anthropoid ape and of man, which arise from the ventricle (fig. 3). The ventricle is present only in the larynx of mammals. It is formed by the splitting up of the common thyroarytenoid sphincter of primitive types into two parts, an internal

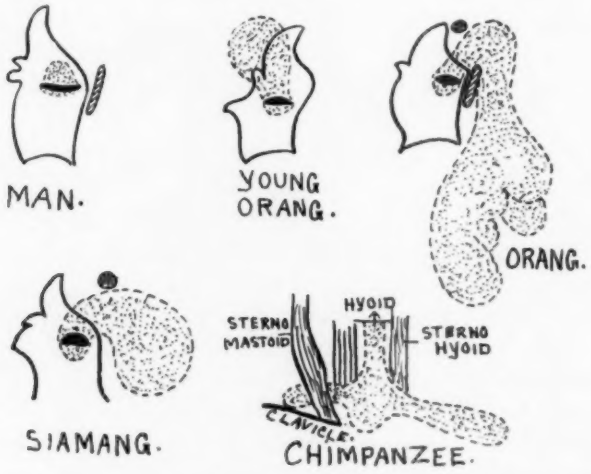

Fig. 3.—Ventricles and ventricular air sacs (after Negus). The entrance through the ventricle is shown by the black area; the ventricular air sacs by the stippled area; the thyroid cartilage, by the cross lined area, and the hyoid bone by the cross hatched area.

and an external division. The upper division becomes the ventricular band, or the false vocal cord; the lower, or internal, division becomes the true vocal cord. Between the two divisions a recess is left. This excavation represents the ventricle. The function of the ventricular band is the same as that of the ventricle, that is, it helps to provide a valve capable of preventing the exit of air from the lungs. The saccules appear to be the degenerated relics, or else the incomplete precursors, of air sacs leading out of the ventricle, with a function directed to rebreathing air. In the siamang, the orang-utan and the chimpanzee these air sacs are fairly large; they extend down the neck through the thyrohyoid membrane between the sternohyoid muscles and then spread out at the root of the neck. They may extend laterally beneath the

sternocleidomastoid muscles under the clavicle and may reach the axilla. Embryologically, according to Frazer,[5] the saccule appears at the end of the second month of fetal life. It issues just above the chordal nodule, which represents the future position of the true cords. At the age of 1 year, the ventricle is continued upward throughout its sagittal extent into a pouch (the sacculus) and never rises higher than in the adult, that is to say, above the upper edge of ala of the thyroid cartilage.

As years pass the ratio between the ventricle and the saccule increases until the parts have reached the adult stage. The saccule is, therefore, more obvious in early life and tends to drop out of sight in the adult. When the human sacculus is compared with the enormous air sac of the orang-utan or the chimpanzee it can easily be seen that these developmental changes illustrate an evolutionary degeneration.

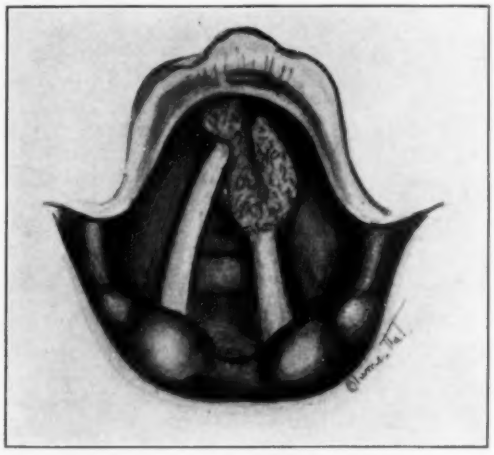

Fig. 4.—The larynx before operation, showing a tumor on the anterior half of the left vocal cord, ventricular band and subglottic region. It also shows fixation of the left vocal cord. (Laryngoscopic picture.)

REPORT OF CASES

CASE 1.—*Pyocele of a Congenital Air Sac of the Ventricle.*

A. M., a man aged 54, presented himself at the Montreal Jewish General Hospital on Feb. 2, 1937, complaining of progressive hoarseness for over two years. He was able to speak just above a whisper. He did not cough. He had not lost any weight. He had no pain. He did not use his voice excessively. He did not drink. He was an inveterate smoker of cheap cigars, five to ten a day. He attributed the hoarseness to this habit.

Examination of the larynx with the laryngeal mirror revealed an infantile epiglottis; the right vocal cord was normal in structure and function. Situated on the anterior half of the left vocal cord was a pinkish gray granular lobulated

5. Frazer, J. E.: The Development of the Larynx, J. Anat. & Physiol. **44**:156, 1909-1910.

tumor spreading over the anterior half of the left ventricle and ventricular band. This mass encroached on the anterior commissure in front and the subglottic region below. The left vocal cord was almost fixed in position on phonation, so that the right cord swung over to it (fig. 4). There were no palpable glands in the neck. Roentgenograms showed the chest to be normal. The Wassermann reaction was negative. The clinical appearance of the tumor, the fixation of the cord and the general findings strongly suggested carcinoma. To my astonishment, the pathologic report on the biopsy of material taken from the tumor came back as "chronic inflammation."

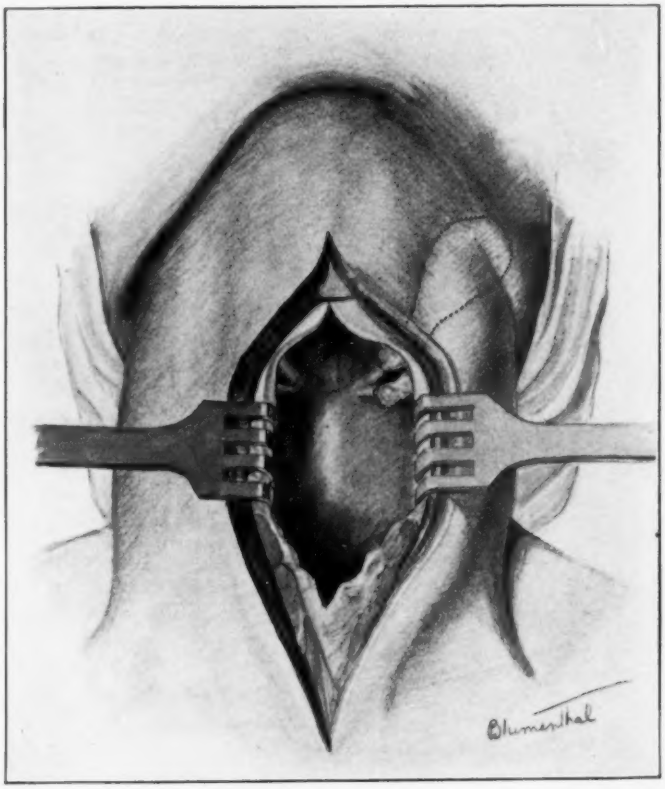

Fig. 5.—Pyocele of a congenital air sac of the ventricle of the larynx. The drawing represents the thyroid cartilage split open for laryngofissure, showing the tumor on the left vocal cord. The air sac is diagrammatically shown in stippled lines in the right upper part of the picture.

I was not satisfied with the report, and two subsequent and very generous snippings were taken. The same diagnosis was returned. I was baffled. Consultation with an eminent laryngologist confirmed my diagnosis of cancer of the larynx. I sent the patient to McGill University, where some interesting hematologic work on carcinoma is being done. It was reported that the differential smear showed possible carcinoma. In spite of the negative pathologic reports I felt that the lesion was cancer and decided to treat it as such. On April 19, I decided to do an exploratory thyrotomy and, if the condition warranted it, a total laryngectomy.

The operation was done with the region under local anesthesia. An incision was made in the midline of the neck from just below the tip of the chin to the sternal notch. The ribbon muscles were identified and retracted. The isthmus of the thyroid gland was cut and the bleeding vessels were ligated. A low tracheotomy was done. The thyroid cartilage was split in the midline, and the thyrohyoid membrane was cut horizontally along the lower border of the hyoid bone. When the split halves of the thyroid cartilage were retracted it was seen that the involvement of the left side of the larynx was more extensive than had appeared preoperatively. A firm, reddish white mass occupied the position of the true vocal cord almost as far back as the vocal process of the arytenoid. The false vocal cord above it, together with the ventricle, was raised; it presented a tumor-like appearance (fig. 5). Because of the localization of the tumor on the left side, it was decided to excise it, with a wide margin of healthy tissue, all the way down to the inner surface at the thyroid cartilage. The tissue to be penetrated was much thicker than normal and bled freely. The incision was started posteriorly and swung forward inferiorly below the tumor. The mass was then grasped and

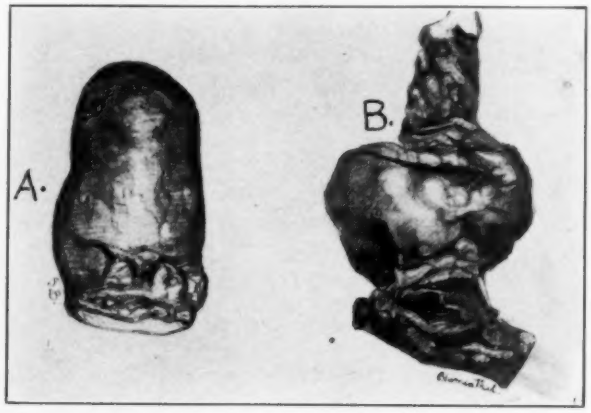

Fig. 6.—*A*, sac of a pyocele. The lower part is the open end, which communicates with the ventricle. *B*, tumor mass excised at operation. The black horizontal line running across the center of the photograph represents the entrance to the ventricle. The true and false vocal cords are partly replaced by tumor.

dissected off the inner surface of the thyroid cartilage. When the mass was freed from its anterior and superior attachment to the thyroid cartilage there was a gush of thick yellow pus. On carefully exploring for the origin of this pus I saw a gaping, velvety, puckered mucous membrane–like opening. This finding was so unexpected and unusual that I asked my assistant what he thought I had encountered. Without any hesitation he suggested that I had cut the esophagus! My second assistant, who had a better knowledge of the more intimate structures of the neck, hinted at a severed thoracic duct, since we were working on the left side.

I decided to explore further in order to see whether I had merely cut the channel that conveys gross food to the stomach or had been so indiscreet as to sever the finer duct, which carries the essence of digestion to the blood stream. This opening admitted the little finger comfortably. A probe passed into it traveled along under the ala of the hyoid bone upward and outward toward the

external auditory meatus of that side, to end in a blind sac. By careful dissection I isolated a smooth outer surface of this sac. It was dissected out in its entirety. The terminal blind end of the sac was attached to a fibrous cord which seemed to run in the direction of the external auditory meatus.

The sac when removed looked not unlike a vermiform appendix. It measured about two inches (5 cm.) long and accommodated the little finger (fig. 6). The wound was tightly closed by three layers of sutures right down to the tracheotomy wound. A cigaret drain was put in the lower angle of the wound above the tracheotomy tube.

Decannulation was done after twenty-four hours. The wound healed by primary intention, and the patient was discharged from the hospital on the twelfth day. After three months a sharp fibrous band developed on the inner surface of the denuded thyroid cartilage opposite the right vocal cord. The patient has a fairly good speaking voice, though it is slightly hoarse.

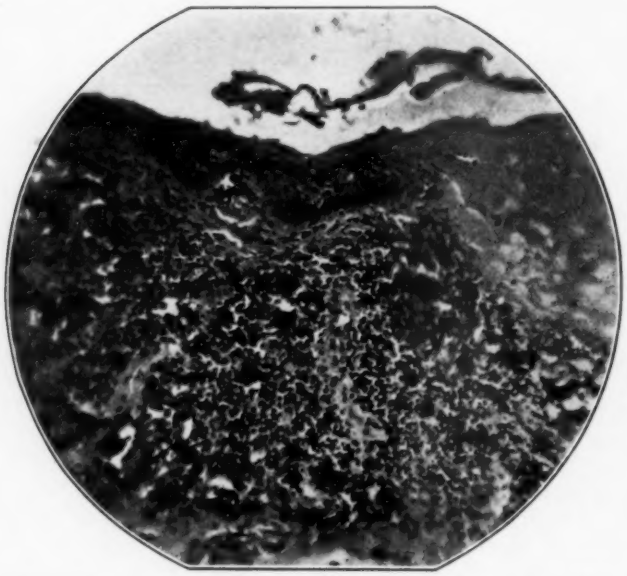

Fig. 7.—Coronal section of tumor mass removed at operation (fig. 6 *B*). The top of the section shows a layer of stratified squamous epithelium replaced on the right by a thick band of fibrous tissue without any epithelial covering. At the depth of the section is shown the extensive leukocytic and round cell inflammatory infiltration.

The pathologic report of the excised tumor mass (fig. 7) was: "Fatty and fibrous tissue overlying muscle fibers. In places the free surface is covered by a layer of stratified squamous epithelium. On one margin of this layer the epidermis is growing down into vascular granulation tissue, suggesting regeneration. Throughout the corium there are areas of perivascular round cell infiltration. In the depth of the tissue are numerous serous and mucous glands showing in places scattered foci of leukocytic and round cell infiltration. Diagnosis: chronic inflammation."

Microscopic description of the sac (fig. 8) was as follows: "Narrow strip of tissue covered on the outer surface by a thin intact layer of fibrous tissue. Its

opposite surface is lined by an intact layer of ciliated columnar epithelium. The intervening tissue is composed of compact lymphocytes, with occasional foci suggesting germinal centers. Throughout there are scattered foci of fibrosis and hyalinization. Diagnosis: Bronchogenic cyst with chronic inflammation."

The bacteriologic report of a smear taken from the contents of the cyst at the time of operation came back as "Staphylococcus aureus."

In retrospect, the sequence of events which led to this rather rare and puzzling condition was probably as follows: The patient had a congenital atavistic laryngeal air sac like that found in the anthropoid ape (fig. 3). Somehow or other it became infected through its opening into the ventricle. The sac became filled with pus, which constantly "leaked" over the anterior part of the cord, the ventricle and the ventricular band, causing chronic inflammation and granulation tissue about the parts involved. This granulation tissue, in turn, dammed back the secretion in the sac in a valvelike manner at its point of exit in the ventricle. This would in time cause the condition found in the region of the true and false vocal cords.

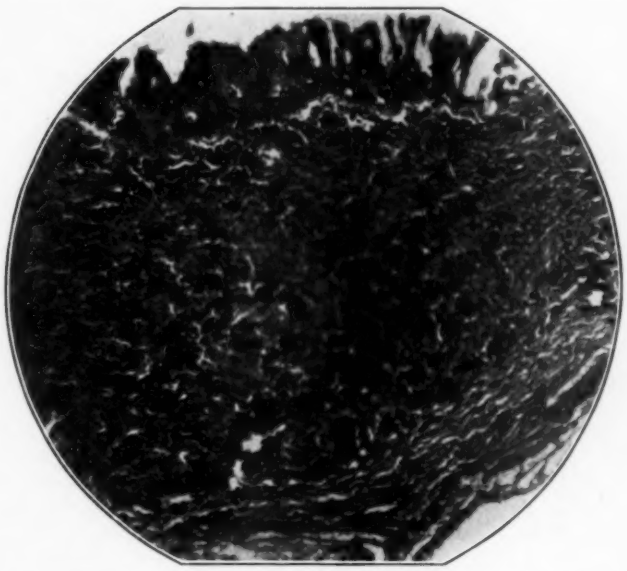

FIG. 8.—A section of the sac of the pyocele (fig. 6*A*). The top of the section shows an intact layer of ciliated columnar cells. Below this layer is a wide zone composed of compact lymphocytes. At the bottom is an intact layer of wavy fibrous tissue.

In my bronchoscopic work I have found a somewhat analogous condition in 4 cases of benign inflammatory papilloma in which the tumor was situated at the opening of the bronchus of the upper lobe of the right lung. All 4 of the patients had cough and expectoration for long periods. The roentgenograms of all had shadows diagnosed as interlobar effusions.

All had papillomas at the opening of the bronchus of the upper lobe of the right lung bathed by pus coming from this bronchus. All the symptoms cleared up rapidly on surgical removal of the tumors through the bronchoscope. In these cases also, a low grade infection of the bronchial tree of the upper lobe (following unresolved pneumonia?) poured out an infected secretion. This caused hypertrophy of the mucous membrane at the opening; then granulation tissue was formed, stenosis of the bronchus occurred and the papilloma dammed back the secretion by its valvular action.

It is justifiable to conclude that the case presented was of a rather rare condition: pyocele of a congenital air sac of the larynx associated

Fig. 9.—Horizontal section of prolapse of the sacculus laryngis. From left to right: layer of stratified squamous epithelium of the ventricular band; thick submucosa, with its normal lymphoid cell infiltration and mucous glands; layer of ciliated columnar epithelium of the sacculus; cavity of the sacculus (*X*); layer of ciliated columnar epithelium at the other side of the sacculus, and cut stroma (*Y*), where the neck of the sacculus was cut at operation from the underlying thyroid cartilage.

with secondary inflammatory changes of the true and false vocal cords and the ventricle, simulating carcinoma.

Kistner [6] reported a case of pyocele of the sacculus laryngis.

A patient had a fluctuating swelling on the right side of the neck and complained of hoarseness, dyspnea and dysphagia. There was a spontaneous and

6. Kistner, F. B.: Pneumatocele and Pyocele of the Sacculus Ventriculi Laryngis, Ann. Otol., Rhin. & Laryng. **33**:891, 1924.

copious expectoration of green pus after a severe attack of dyspnea, with relief. The growth was opened endolaryngologically three times by a laryngologist before a proper diagnosis was made. Finally the sac was dissected out through an external incision on the side of the neck in the region of the outer swelling. The wall of the sac was very thin, and its neck passed through the thyrohyoid membrane into the ventricle of the larynx. The neck of the sac was tied and cut off. The patient recovered his voice completely, and all other symptoms disappeared. The histologic report on the sac, in part, read as follows: "The wall of the sac is ragged. In places, it is as thin as tissue paper; in others it is a few millimeters thick."

CASE 2.—*Prolapse of the Sacculus of the Ventricle of the Larynx.*

A man aged 42 came to the clinic of the Montreal General Hospital on Sept. 16, 1936. His complaints were hoarseness and cough. They followed an attack of pneumonia seven months previously.

The patient appeared healthy and robust. There was mild bronchitis, with a moderate amount of sputum. The heart was normal. The systolic blood pressure was 120, and the diastolic, 70. The nose and throat were normal.

A smooth, round, pinkish gray tumor about the size of a small cherry was seen occupying the space above the anterior half of the right vocal cord. It touched the posterior surface of the epiglottis just below the aryepiglottidean fold on the right side. It shifted its position as to both size and contour on repeated examination. The tumor could not be replaced in the ventricle with a probe.

A thyrotomy was done by Dr. George Hodge. When the thyroid cartilage was divided and the cut ends retracted, the tumor was found to be attached by a broad base to the upper limit of the right false vocal cord; it extended upward along the aryepiglottic fold. The cyst was removed by sharp dissection. After removal it was found that the wall of the cyst was complete. There was very little bleeding. A tracheotomy was not done. The patient's voice improved.

Microscopic examination of the removed tissue showed a covering of stratified squamous epithelium with intact basement membrane. In the tunica propria there were several nests of mucous glands with chronic inflammatory cells scattered throughout. In the deep layer of the tunica propria there was part of the wall of the prolapsed sacculus, lined with ciliated columnar epithelium, resting on a basement membrane. The cavity of the sacculus was surrounded by this intact epithelial covering (fig. 9).

The correct diagnosis in this case was not made until the pathologic report was carefully coordinated with the clinical and operative findings. The original clinical diagnosis was cyst of the larynx. Prolapse of the sacculus of the ventricle is not a common condition. The first case to be described was reported by Moxon[7] in 1868.

The best monograph on the subject is by Irwin Moore,[2] who has made a study of 85 cases, the total number of cases recorded in the literature up to 1922.

By "prolapse of the ventricle," the term in general use, is to be understood the protrusion of a portion of the ventricular mucosa as the result of inflammatory edema or hyperplasia, so that parts of the

7. Moxon, W.: Case of Eversion of the Sacculus Laryngis, Tr. Path. Soc. London **19**:65, 1868.

ventricle normally out of sight are carried inward along the swelling and come into view through the laryngoscope. In this case the history of pneumonia and subsequent severe cough for seven months previous to admission was the probable cause of the prolapse.

Dr. George Hodge permitted the publication of this case.

CASE 3.—*Laryngocele.*

A boy 9 weeks old was admitted to the children's ward of the Women's General Hospital in June 1937, to my service, for a swelling on the right side of the neck, which appeared when he cried. General examination revealed nothing unusual except perhaps a slight degree of malnutrition. When the child was quiet nothing unusual was noticed in the neck; but when he cried a sausage-like swelling appeared on the right side of the neck, starting from the region of the thyroid cartilage and extending obliquely upward and outward to the right angle of the mandible. This swelling was "airy" to the touch and tympanitic on percussion.

Direct laryngoscopic examination revealed nothing unusual. I kept the child under observation for six weeks. He throve; he gained weight. He had no difficulty in swallowing. On discharge he had the same condition of the neck as when he was admitted.

This condition was probably a morphologic reversion to the higher apes, with a persistent air sac communicating with the ventricle. When the child cried the ventricular bands closed and the air was forced into the sac from the lungs. Sir William de Courcy Wheeler [8] described an analogous case.

The patient was a man aged 24 who suffered all his life from a painless bulge in the right submaxillary region. The swelling was tympanitic and disappeared under pressure. The unusual feature about this case was that the swelling extended upward to the base of the tongue and could be seen on the posterior part of the tongue on the right side when the mouth was opened and the tongue depressed.

In Wheeler's monograph there is a photograph of a skilful dissection of a congenital laryngocele which was accidently discovered in the dissecting room and is preserved in the anatomic museum of Trinity College, Dublin.

Laryngocele is a comparatively rare condition. Hansberg [9] in 1913 stated that only 24 cases had been published up to date, and in most of these the formation was accidentally observed at autopsy or in the dissecting room. Spicer [10] in 1921 reported another interesting case.

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8. Wheeler, W. I. deC.: Pillars of Surgery: John B. Murphy Oration, Surg., Gynec. & Obst. **56**:257, 1933.

9. Hansberg, D.: Laryngofissuer bei Laryngocele, in Katz, L.; Preysing, H., and Blumenfeld, F.: Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege, Würzburg, Curt Kabitzsch, 1913, vol. 4, p. 192.

10. Spicer, F.: Case of Laryngocele, Proc. Roy. Soc. Med. **14**:16, 1921.

SUMMARY

It is pointed out that the function of the larynx is not primarily that of phonation but that of an inlet valve for the purpose of respiration.

The ventricle of the larynx and its upward extension, the sacculus ventriculi laryngis, are described.

The sacculus in man is the vestigial homologue of the ventricular air sac of the higher apes and other animals. The function of these air sacs is respiratory. They are not resonance chambers, as was formerly supposed.

The importance of realizing the abundance of mucous and serous glands surrounding and discharging into the sacculus and ventricle is emphasized.

It is suggested that the sacculus may act as an oil can to the vocal cords and that some of the common diseases of the larynx, such as laryngitis, singers' nodes, pachydermia and contact ulcers, may be due to either a diseased or a perverted secretion of these glands.

It is hinted that cancer, tuberculosis and benign papillomas of the larynx arise from the ventricle and sacculus much more frequently than has hitherto been suspected. The laryngoscopic picture of these conditions is the end result of a "spill over" from the ventricle to the neighboring structures.

A rare case of infected congenital laryngeal air sac is described. The lesion was diagnosed as carcinoma of the larynx. It was only at operation and after further study that the true diagnosis was made—pyocele of a ventricular air sac of the larynx.

A case of prolapse of the sacculus ventriculi laryngis is described.

A case of laryngocele, the patient being an infant 9 weeks old, is reported. Prolapse of the ventricle is the result of some pathologic condition in the neighborhood of the normal sacculus. Pyocele and laryngocele are possible only when there is a morphologic regression in the human larynx.

The lesions in the 3 cases reported must not be confused with branchiogenic cyst or cyst of the thyroglossal duct. The last two are derived from the primitive pharyngeal pouches and the branchial clefts, respectively, and do not communicate with the ventricle.

Clinically, cyst of the thyroglossal duct is always in the central line of the neck. The branchial cyst is situated laterally in the region of the ala of the hyoid bone, in the same location as laryngocele and pyocele. The branchiogenic cyst is filled with clear amber fluid when not infected and is easily transilluminated. Laryngocele is filled with air and increases with crying or exertion. Pyocele of the larynx is extremely rare. When the differential diagnosis is difficult, the aspirating needle and roentgen examination of the cavity after the injection of iodized poppyseed oil may be of assistance.

CANCER OF THE LARYNGOPHARYNX

HENRY BOYLAN ORTON, M.D.
NEWARK, N. J.

I am confining my comments to malignant tumor of the laryngopharynx, better known as extrinsic cancer of the larynx, which includes growths in the epiglottis, the aryepiglottic folds, the lateral and the posterior pharyngeal wall, the piriform sinus and the postcricoid region, or, in other words, in the area from the tip of the epiglottis to the opening in the esophagus.

This small area is the all too frequent site of malignant tumor at its worst, and to the laryngologist it is the field of the most interesting problems of surgery of the neck.

I agree with Beck and Guttman,[1] who stated "that hypopharyngeal malignancy is not altogether a hopeless condition. If the lesion is seen early, when it is small and localized, . . . some hope is present that the patient can be subjected to a successful lateral transthyroid pharyngotomy."

The area is not difficult to examine, nor is it difficult of access, yet it is surprising how far lesions have advanced before diagnosis is made. There is infection by infective material as soon as the pharynx is opened.

Thirty years ago a small epithelioma of the lower part of the pharynx meant a certain and painful death. Thanks to Trotter,[2] surgeons now have access to this region. They know a great deal more about the infectivity of the pharyngeal contents and how it can be controlled, and they are more familiar with plastic reconstruction of the pharynx, the types of malignant disease to which it is subject and the means of attack.

Gordon B. New and J. M. Waugh[3] stated: "It is apparent that physicians in general are not acquainted with the good results obtained

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This paper and the one by Drs. Harris and Klemperer, which follows, were read in a symposium on laryngeal cancer at the Forty-Fourth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Atlantic City, N. J., April 28, 1938. Two other papers read in this symposium, by Dr. C. J. Imperatori and Dr. L. A. Schall, will appear in the next issue.

1. Beck, J. C., and Guttman, M. R.: Carcinoma of the Hypopharynx, Ann. Otol., Rhin. & Laryng. **42**:286 (March) 1933.

2. Trotter, W.: Surgery of Malignant Disease of the Pharynx, Brit. M. J. **1**:269 (Feb. 13) 1926.

3. New, G. B., and Waugh, J. M.: Curability of Carcinoma of Larynx, Surg., Gynec. & Obst. **58**:841 (May) 1934.

in the surgical treatment of carcinoma of the larynx; that is, the very small operative mortality and the high percentage of 5 year cures."

It is generally thought that some form of radiation therapy will completely change the treatment of cancer in this area and that surgical intervention will no longer be the method of choice. However, I feel that malignant disease in this area is curable by surgical means. As Pilcher [4] stated, "whatever method of treatment is favoured, it will obviously have more chance of success if diagnosis is made early." This is true whether it is surgical intervention or some form of irradiation or a combination of both.

FREQUENCY

Malignant growth in this area is not rare; its manifestations are common enough to be neglected, and it is sometimes not diagnosed for many months. Usually one year has elapsed from the time the patient

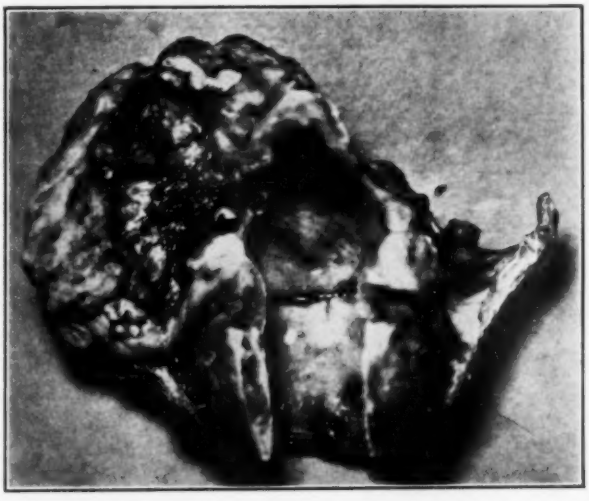

Fig. 1.—Epidermoid carcinoma involving the epiglottis, the lateral wall of the pharynx and the tongue. The patient (fig. 2) is alive and well two and one-half years after operation.

realizes that something is not altogether right in his throat before treatment or advice is sought. Even then, the patient is apt to wait until he feels some enlarged cervical glands before having treatment instituted.

The following case is typical:

A woman aged 49 consulted me in 1936, complaining of difficulty in swallowing. One year previously the patient had first noticed this difficulty, with pain radiating to the ear, accompanied by hoarseness and coughing. In view of the size of the growth removed at operation it scarcely seems possible that the condition could have gone unrecognized for such a period (fig. 1). In this instance it

4. Pilcher, R.: Diagnosis of Malignant Disease of the Pharynx, Brit. M. J. 1:13 (Jan. 2) 1937.

was necessary to do a laryngopharyngectomy and to reconstruct the patient's pharynx. Figure 2 shows a photograph of the patient after plastic closure. This patient was operated on more than two and one-half years ago and is alive and well at the present time.

Additional cases, similar to this, could be cited.[5]

Fig. 2.—Patient after reconstruction of the pharynx following laryngopharyngectomy (fig. 1).

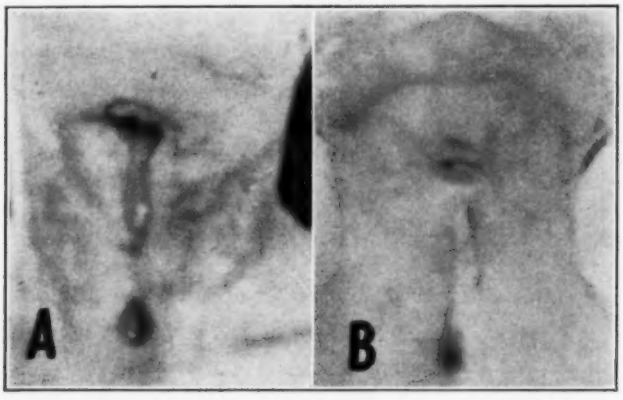

Fig. 3.—Laryngopharyngectomy; tracheal and pharyngostomy opening (*A*) before plastic closure and (*B*) after plastic closure. There was a recurrence two and one-half years after operation.

Unfortunately many a tonsil has been removed for a malignant growth of the laryngopharynx.

5. Orton, H. B.: Lateral Trans-Thyroid Pharyngotomy, Arch. Otolaryng. **12**:320 (Sept.) 1930; Diagnosis and Treatment of Malignant Condition of the Laryngo-Pharynx, J. A. M. A. **98**:290 (Jan. 23) 1932; Laryngectomy, Single Stage—Operative Results. Tr. Am. Laryng., Rhin. & Otol. Soc. **38**:81, 1932.

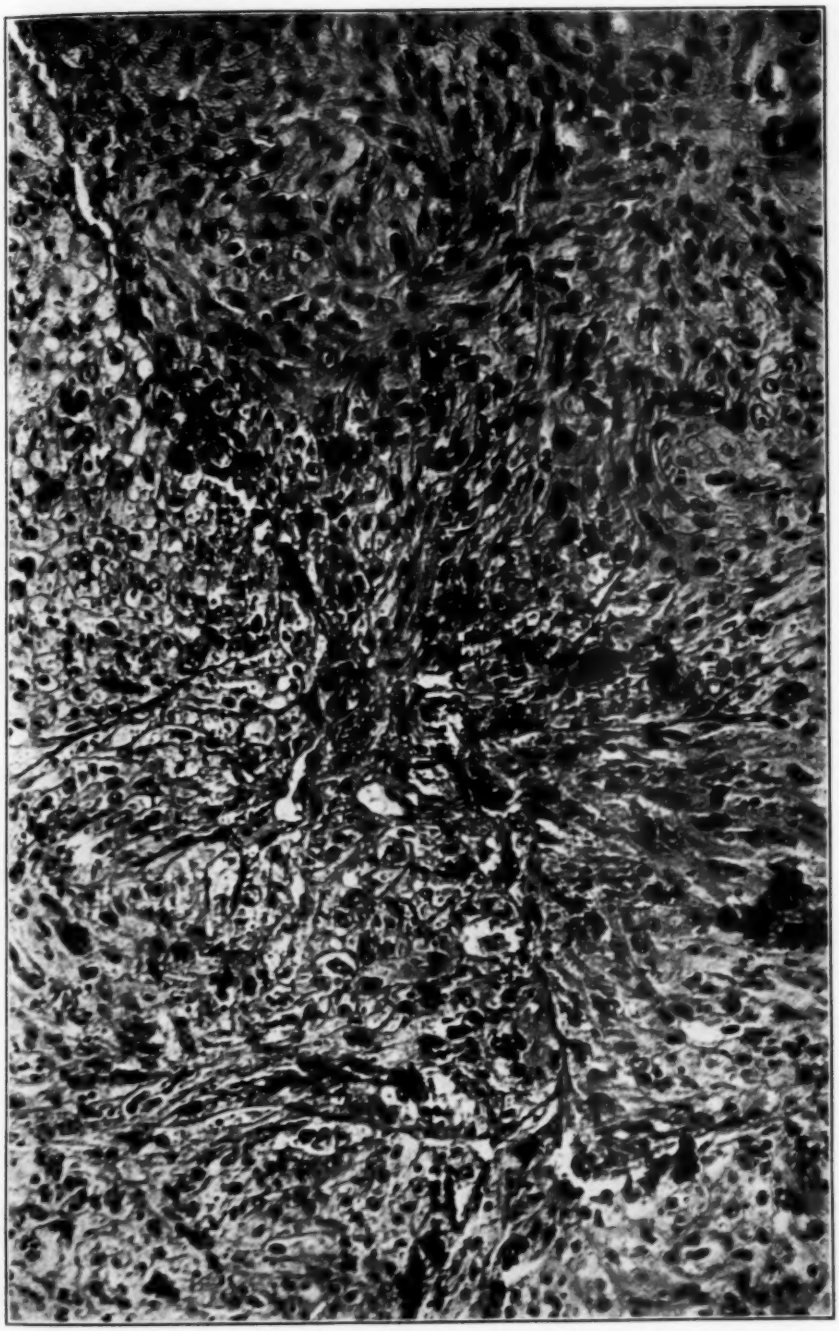

Fig. 4.—Melanosarcoma; encapsulated vascular tumor in lobulated arrangement composed of melanophores with pigment, spindle cells and giant cells (low power).

Fig. 5.—Same as figure 4 (high power).

INCIDENCE ACCORDING TO AGE AND SEX

The epilaryngeal type of growth is more common in men than in women, whereas the hypopharyngeal is almost entirely limited to women. The greatest number of patients are between the fortieth and the sixtieth year of life, although I have seen a myxosarcoma in a man aged 27 and a melanosarcoma in a woman aged 43 (figs. 4 and 5). Both patients were operated on by lateral transthyroid pharyngotomy.

PROGRESS

Cancer in this area does not grow rapidly, and unfortunately there are not sufficient signs or symptoms for patients to seek treatment early.

I have found that a vast majority of the patients with a malignant tumor in this area, like those with a similar growth in the esophagus, have carious teeth. The infection from these teeth often causes slight enlargement of the cervical glands, which later subsides somewhat. Therefore, any patient with enlargement of the cervical glands, no matter how slight, with or without carious teeth, in the age period of greatest susceptibility to cancer, should be suspected of having cancer until it is proved otherwise. Any abnormal sensation in this area that has extended over a time should be regarded seriously. Pain is intermittent and not constant.

CLASSIFICATION

Malignant growth in this area is usually of the squamous cell type. Figure 6 *B* shows a small epithelioma of the lateral wall of the pharynx removed by lateral transthyroid pharyngotomy. Figure 6 *A* shows a large postcricoid malignant tumor which was removed by a laryngopharyngectomy with reconstruction of the pharynx. The patient died of a recurrence two and one half years after operation. Figure 6 *C* shows a growth removed from the posterior pharyngeal wall by lateral transthyroid pharyngotomy.

SYMPTOMS

Symptoms depend on the site of lesion, usually beginning with some abnormal sensation; when a tickling sensation or constant clearing of the throat is persistent, one should awaken to the fact that one may be dealing with a malignant growth. Other symptoms are a sensation of a foreign substance which cannot be dislodged, increased salivation and, in the hypopharynx, mucus in either piriform sinus that cannot be emptied by swallowing. Later symptoms include alteration of voice, accompanied by choking at or between meals, due to anesthesia or analgesia of the posterior branch of the inferior laryngeal nerve. Loss of appetite, difficulty in swallowing and enlarged fixed cervical glands denote a late and too often an inoperable state. These symptoms therefore present a serious problem.

Glands are affected early; the course is fairly rapid, and unless prompt treatment is instituted a year or a year and one half is the average span of life for the patient. It is true that not all cancers can be cured, but certainly if the region is examined with painstaking thoroughness much can be accomplished by early diagnosis and radical surgical intervention.

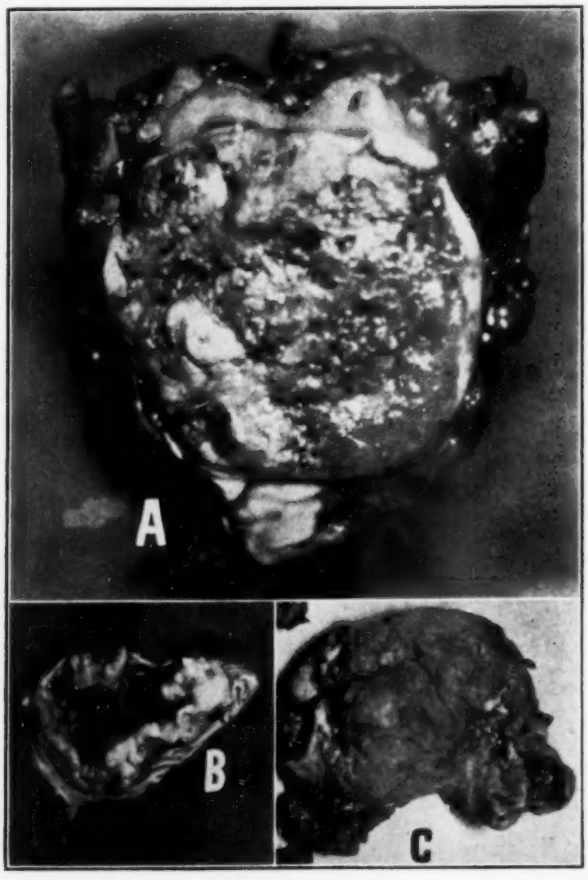

Fig. 6.—*A*, postcricoid carcinoma. The patient lived two and one-half years after laryngopharyngectomy and reconstruction of the pharynx. *B*, carcinoma of the lateral wall of the hypopharynx, removed by lateral transthyroid pharyngotomy. *C*, growth removed from the post hypopharyngeal wall by lateral transthyroid pharyngotomy.

DIAGNOSIS

Too often when patients present themselves for examination they are beyond any hope of a five year cure. When the symptoms enumerated are present, a thorough examination of the area should be made, just as would be done for intrinsic cancer of the larynx.

One patient, aged 43, gave a history of difficulty in swallowing and clearing mucus from the throat for the past two weeks. This was accompanied with slight hoarseness and difficulty in breathing, which became progressively worse. With all this there was a new tender mass on the right side of the throat. The patient complained also of severe pain deep in the right ear. Yet she stated that she first noticed trouble one and one-half years previously when she had measles; at that time a sore throat developed, with a mass in the side of the neck. This gave pain for about eight months and then subsided, but the mass remained. Although the condition which impelled her to seek treatment was of two weeks' duration, friends had noticed an alteration in her voice for some time, and her real trouble began about one and one-half years previously.

Laryngoscopic examination with a mirror revealed a mass the size of a walnut arising from the right side of the pharynx, almost filling the pharyngeal airway, extending across the midline and preventing a view of the larynx. The mucosa was dull but intact. The mass was not pedunculated and was hard to the examining finger.

In the neck was an indurated mass on the right side at the level of the superior border of the thyroid, which rose and fell with deglutition. It was moderately tender and not entirely discrete.

On Nov. 16, 1936, a lateral transthyroid pharyngotomy was performed, with removal of the growth. The patient was discharged to her home in a neighboring state on December 16. The growth was a melanosarcoma from the lateral wall of the pharynx (figs. 4 and 5).

The laryngologic examination, which is the most important part of the examination, is often overlooked, not because it is difficult but because a clear view is not always obtained. One must obtain a good view of the hypopharynx, see the movements of the arytenoids on phonation and inspiration and ascertain whether there is mucus in the piriform sinus which cannot be emptied by swallowing. The laryngeal picture may give the appearance either of a chronic ulcer, with raised margins and depressed ulcerating center, or of a sessile growth projecting into the lumen; fixation of the arytenoids may be noted, or the cavity may be filled with a large mass, the surface either ulcerating or sloughing. If the arytenoids are fixed and no growth is seen, the piriform sinus may be the site of the growth. The patient is instructed to say "E," thus elevating the larynx and bringing into view slight edema below the arytenoids; if the upper edge of an ulcer is seen, it is diagnostic of a malignant process. Further study with roentgen rays, followed by direct laryngoscopic or esophagoscopic inspection, with removal of a specimen for biopsy, will complete the examination. As many have stated, final decision as to the nature of the growth can be made only after a histologic study of a piece of the growth.[6] Forward displacement of the larynx, palpation of the growth and enlarged fixed glands are all late signs, although when they have been seen early good surgical results have been reported.

6. Clerf, L. H., and Crawford, B. L.: Carcinoma of the Larynx: Clinical and Pathologic Aspects, Arch. Otolaryng. **16**:676 (Nov.) 1932.

TREATMENT

The treatment and prognosis depend to a great extent on whether or not the starting point of the lesion is known. When the growth is on the epiglottis, good results—either a cure or prolongation of life by a number of years—may be obtained by proper operative procedure.

Treatment of the lateral and the posterior pharyngeal type gives good results if the patient is seen early. Growths of the piriform sinus, however, in the epilaryngeal area and in the postcricoid region in the hypopharyngeal area have the poorest prognosis, although if they are seen at a very early stage surgical intervention may be valuable.

The features of Trotter's [7] operation, lateral transthyroid pharyngotomy, as a surgical approach to the lower part of the pharynx are: (1) the isolation of the area of gland dissection from the visceral planes of the neck by suturing the sternocleidomastoid muscle to the prevertebral muscles; (2) the removal of the thyroid cartilage and the cornu of the hyoid bone before the pharynx is opened, so that the growth may be palpated through the pharyngeal aponeurosis; (3) the closure of the wall of the pharynx in early stages, by which immediate reunion of it may be obtained; (4) the combination of the operation with a plastic procedure when necessary.

Preoperative Preparation.—The patient is admitted to the hospital four or five days prior to the date of operation. During this time the metabolic rate is determined, chemical analysis of the blood is made and roentgenograms are taken. The internist examines the patient's cardiovascular system and gives his opinion of the operative risk.

Careful attention is given to the cleansing of the mouth with a tooth brush and a mouth wash of 25 per cent alcohol before and after eating.

The colon is cleansed by a laxative and a high enema of pure sodium bicarbonate, 1 drachm (3.88 Gm.) to 2 quarts (2 liters) of water; this is followed by colonic irrigations of saline solution through a large colon tube, 2 or 3 gallons (8 to 11 liters) of the solution being used.

Every other day a modified irrigation using 1 gallon (4 liters) of saline solution is given.

Sodium bicarbonate, 3 drachms (12 Gm.) in twenty-four hours, is given by mouth between meals for three days preceding operation.

The diet is nutritious and of a low protein content, no eggs, milk or beef being allowed. Well cooked cereals with cream, chicken, thick soups, spaghetti, rice, bread and butter, vegetables, fruits and juices are given.

Operation is preceded by twelve hours' starvation; water is allowed up to within three hours of operation.

Three hours before operation the neck is shaved well back, and the upper part of the chest is shaved; green soap on cotton (no brush) and sterile water are used, and then alcohol. No dressing is applied.

The bladder is emptied at the last moment.

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7. Trotter, W.: Some Principles in the Surgery of the Pharynx, Lancet **2**: 833 (Oct. 17) 1931.

Operation of Lateral Transthyroid Pharyngotomy.—A preliminary tracheotomy having been performed, an incision is made along the anterior edge of the sternocleidomastoid muscle from the angle of the jaw to the suprasternal notch; from this, another incision is made, more or less at right angles, extending along the lower border of the jaw to the symphysis. These incisions vary, depending on the type of operation and the amount of tissue to be removed. The flaps and the platysma myoides muscle are turned back. The superficial fascia, the submaxillary gland and the deep fascia are likewise removed upward and backward as far as the spinal accessory nerve and the posterior triangle. This step exposes the deep vessels of the neck and the muscles surrounding the larynx. All the vessels that come off anteriorly from the great vessels are ligated and cut. The internal jugular vein is ligated and resected. The external carotid artery may or may not be ligated. The sternocleidomastoid muscle may or may not be removed, according to the degree of glandular involvement.

The next step is to suture the sternocleidomastoid muscle to the prevertebral fascia. This covers the great vessels and thus protects them from infection when the pharynx is opened.

Fig. 7.—Lateral transthyroid pharyngotomy. A growth of squamous cell type was removed from the left lateral wall of the hypopharynx. The patient, 71 years of age at the time of operation, is living and well over three years later, with no recurrence.

Next, the muscles are reflected from the hyoid bone and the thyroid cartilage. The constrictors of the pharynx are reflected, and the great cornu of the hyoid bone and the thyroid cartilage are exposed for removal by heavy scissors. This permits one to palpate the growth through the pharyngeal aponeurosis and mucous membrane and to decide where to make the opening into the pharynx so as to pass well around the malignant area; if the growth is too large and fixed, one may back out, so to speak, and not proceed any further.

The next step is to open the pharynx, an incision which gives an approach to either a hypopharyngeal or an epilaryngeal growth. Before operation one has a fair idea of how much tissue it will be necessary to remove, and the flap is made sufficiently large to fill up the defect. A feeding tube is inserted into the esophagus, and later a plastic operation is performed to close the neck.

Postoperative Care.—The gown is changed before leaving the operating room. The bed has been warmed and the hot water bags removed before the patient is put into it.

Five hundred cubic centimeters of 5 per cent solution of dextrose is administered intravenously.

A suction pump is installed beside the patient's bed and kept there.

A necessary laryngectomy or tracheotomy tray with duplicate tube is always in readiness.

Frequent changing of dressings is important for the reason that the infection which always takes place in operations in which the pharynx has been opened is sloughing cellulitis, nonsuppurative, which lasts about ten days, after which suppuration and separation of slough begin.

The patient's position is changed frequently. Saliva from the mouth is removed by suction. A mouth wash of 25 per cent alcohol is used.

No morphine is given. The patient is out of bed the next day.

The diet is of high caloric value.

Special nursing is provided.

CONCLUSION

I conclude by quoting Trotter:[7]

For the cases that formerly could be dealt with only by these heroic operations, to some extent we already have, and certainly in the future shall have, a much better resource in the expert, precise, and enterprising use of radium. To those who do not grudge the learning of an exacting technique and the risk of many disappointments there is here a promising field for courage and ingenuity.

It is to be hoped, however, that the number of cases of the severer type will diminish when the natural history of these growths becomes more generally known and it is learnt that the diagnosis is usually easy at an early stage if one knows what to look for.

The future development of the subject probably lies then, on the one hand, in the exploitation of radium, and on the other in that of early diagnosis. Should the latter be cultivated on an adequate scale, the operative excision of small pharyngeal epitheliomas will probably long remain a legitimate field for the surgical adept and a field in which he may look with confidence for cures with little risk to life and no persistent disability.

There are always some cases in which whatever type of treatment is instituted will be of little avail.

PATHOLOGIC DIFFERENTIATION BETWEEN RADIOSENSITIVE AND NONRADIOSENSITIVE MALIGNANT NEOPLASMS OF THE LARYNX

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AND
PAUL KLEMPERER, M.D.
NEW YORK

Primary malignant neoplasms of the larynx are for the most part carcinomas. The small remaining percentage is largely made up of angiosarcomas and lymphosarcomas. A discussion of the pathologic differentiation between radiosensitive and radioresistant malignant neoplasms can be limited for practical reasons to carcinoma.

The differentiation between radiosensitive and radioresistant tumors is based on their response to the action of roentgen rays or of radium. Radiosensitivity is the resultant of many factors, some of which are not understood today. Undoubtedly one of the most important factors is the technic, i. e., the type and dose of radiation employed. This fact is clearly brought out by the recent success in the treatment of cancer of the larynx by roentgen rays, especially since new time factors, spacing and protraction of the irradiation according to the principles of Coutard have been employed. The efficacy of radiotherapy on certain types of tumors can reliably be estimated only if physical factors are constant and if the tumors receive comparable amounts and types of irradiation. This self-evident condition, however, has been fulfilled only within the past few years, since Coutard's principles have been introduced and standardized.

An estimate of the efficacy of radiotherapy and accordingly of the radiosensitivity of malignant tumors of the larynx can be made only on the strength of our limited experience during the past few years. Naturally we are at a distinct disadvantage because we have not treated enough patients to draw final conclusions. We are particularly handicapped if we are to study the significance of various individual or combined factors which may influence the result of therapy. From a

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From the Department of Radiotherapy and the Laboratories of The Mount Sinai Hospital.

Read in a symposium on laryngeal cancer at the Forty-Fourth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Atlantic City, N. J., April 28, 1938.

strictly pathologic point of view, first the cellular structure of the tumor must be considered, next the macroscopic appearance (Stewart,[1] Lenz [2]) and the reaction of the stroma toward the malignant cells, and last, but not least, the exact location of the neoplasm. It is evident that a statistical evaluation of the importance of each of these factors could be based only on a large number of cases. This is not possible at present for any single investigator. Collective investigations are therefore needed, and they are possible only if each factor is sharply and clearly circumscribed, in order to give an objective description of each observation.

We have attempted to classify our cases according to the factors mentioned before. Unfortunately, certain difficulties prevent a definite grouping of some cases. For instance, the primary site of origin of many laryngeal neoplasms cannot be strictly defined in the advanced stages, and the macroscopic appearance is often obscured by infection and edema.

It would appear that the microscopic examination might offer a good opportunity for a strictly scientific differentiation. Yet even with it certain difficulties are encountered which limit us in estimating the value of histologic investigation as a determining factor in the indication for treatment either by surgical intervention or by irradiation and in the prognosis. The question has repeatedly been raised (Hautant,[3] Lenz [4]) whether the small fragment of tumor removed for histologic diagnosis is representative of the entire tumor. We had the opportunity of studying this question in cases in which surgical removal of the entire growth followed the taking of the specimen for biopsy. In a considerable number of instances we found that the histologic picture of the biopsy specimen did not fully conform with that of the entire tumor as regards the degree of differentiation and other cytologic features. Cancers of the larynx are classified, like tumors of other organs, according to the degree of differentiation of the cells. Hornification and the presence of intercellular bridges serve as the dividing line between the mature (figs. 1 and 2) and the immature (figs. 3 and 4) cellular type. It seems to us immaterial in principle whether one classifies the material according to Broders'[5] method, in four

1. Stewart, F. W.: Radiosensitivity of Tumors, Arch. Surg. **27**:979 (Dec.) 1933.

2. Lenz, M.: Radiotherapy of Cancer of the Larynx, Am. J. Surg. **30**:259, 1935.

3. Hautant, A.: La radiotherapie des cancers intralarynges, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:15, 1937.

4. Lenz, M.: Roentgenotherapy of Malignant Neoplasms of the Pharynx and Larynx, J. A. M. A. **99**:1840 (Nov. 26) 1932.

5. Broders, A. C.: Epithelioma of Cavities and Internal Organs of the Head and Neck, Arch. Surg. **11**:43 (July) 1925.

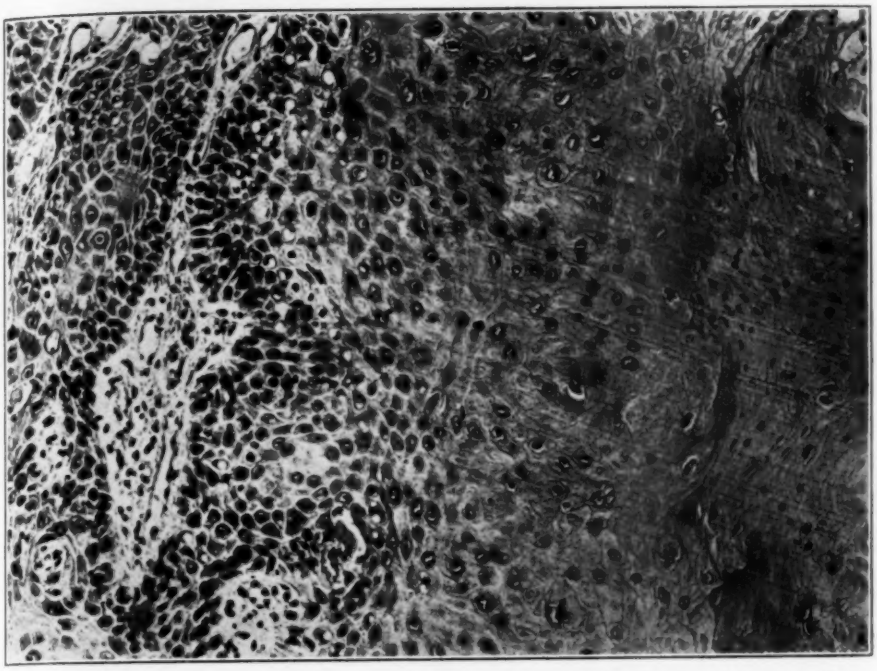

Fig. 1.—Mature squamous cell carcinoma of type 1, in the posterior portion of the right vocal cord. The patient was treated in the spring of 1932 and was well in 1938.

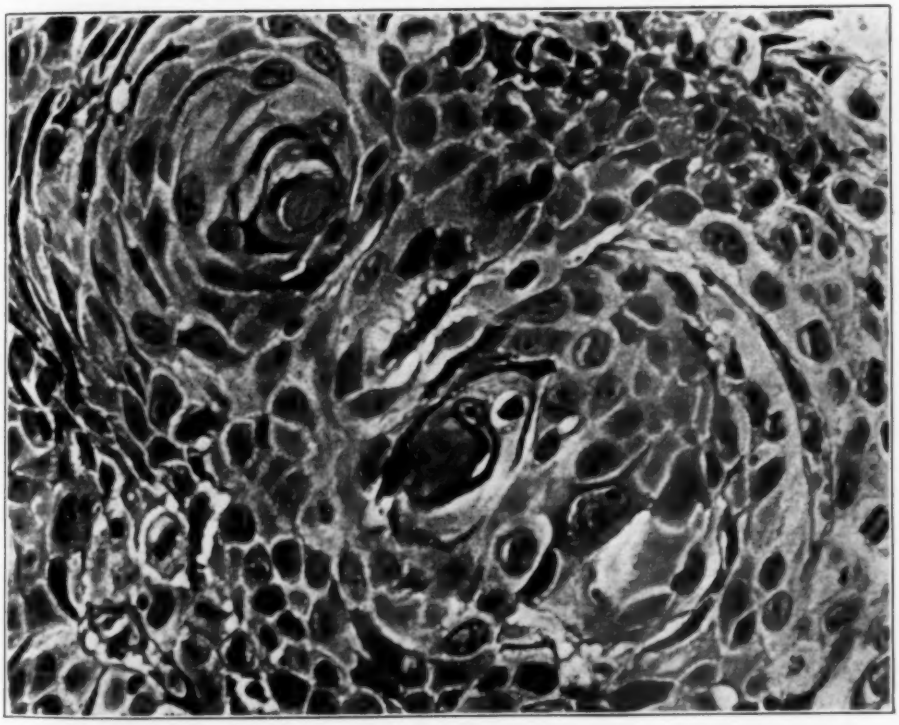

Fig. 2.—Mature squamous cell carcinoma of type 1, involving the entire right vocal cord and part of the left. The patient was treated in the summer of 1932 and died in January 1934.

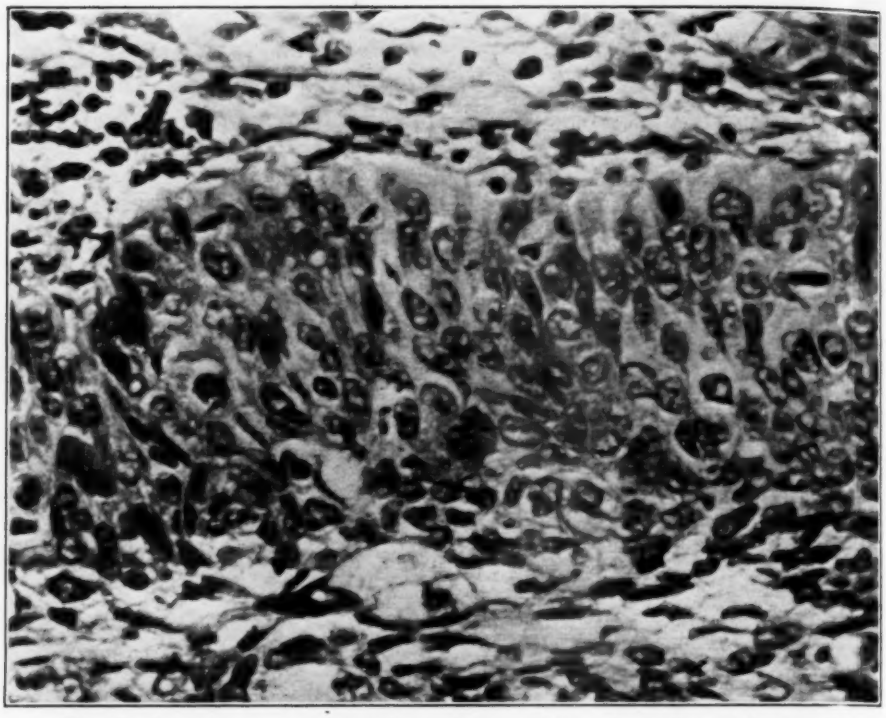

Fig. 3.—Immature squamous cell carcinoma of type 3, on the epiglottis. The patient was treated in the spring of 1933 and was well in 1938.

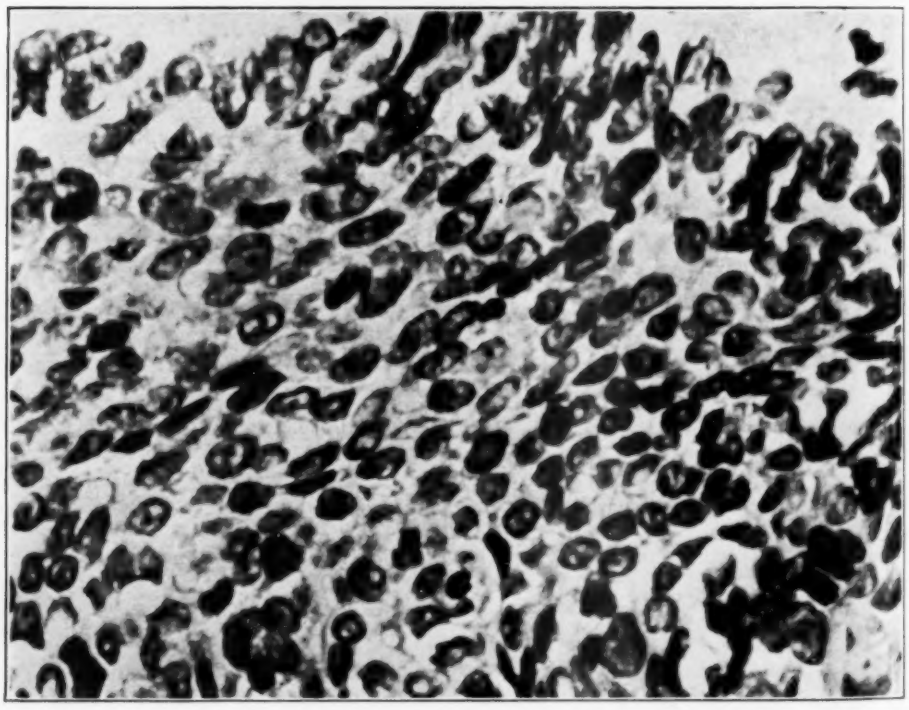

Fig. 4.—Immature squamous cell carcinoma of type 4, involving both vocal cords. The patient was treated in the spring of 1935 and died in the summer of 1936.

grades, or as is done by Duval and Lacassagne,[6] in three grades. There is, however, a personal factor in determining the grade of differentiation which makes it preferable not to use too many subdivisions. The degree of atypism of the individual tumor cells and their nuclei and the frequency of mitoses are often taken together in determining the grade of the tumor. This fact makes the procedure more complicated and still less objective. In the study of our cases we recorded separately the three cytologic factors; and in addition evaluated the type and the intensity of the reaction in the stroma.

We have had the opportunity of studying 32 successive cases of laryngeal carcinoma in which the only treatment was roentgen irradiation according to the principles of Coutard. In the same period we studied 2 sarcomas of the larynx and 1 cylindroma, which also were treated by roentgen rays. All of the lesions occurred on the epiglottis

TABLE 1.—*Physical Factors Employed in the Roentgen Therapy of Laryngeal Carcinomas*

Kilovolts 180 to 200.....	Milliamperes 4 to 15*
Focal skin distance 50 to 60 cm.	Filter 2 mm. copper or Thoraeus filter †
Portals of entry.....	2 lateral, occasionally 1 anterior
Size of portal.....	50 to 100 sq. cm.
Daily dose.....	200 to 400 r measured in air
Total dose.....	3,500 to 4,000 r to each of 2 lateral ports
	1,000 to 2,000 r to anterior field
	Dose to lateral fields reduced when anterior field is used
Time.....	Daily treatments except Sundays—30 to 40 days

* A higher rate of r/m flux was used only during the last year.

† This is a compound filter, devised by R. Thoraeus, which consists of 0.4 mm. of tin, 0.25 mm. of copper and 1 mm. of aluminum.

or within the larynx. Lesions of the piriform sinus and of the hypopharynx were not included.

Table 1 illustrates the physical factors used in the treatment of laryngeal carcinoma in our cases.

Twenty of the 32 patients responded favorably to the roentgen therapy. Twelve failed to respond. Of the 20 patients who responded favorably, 7 have been followed for more than five years, 8 for more than two years and 5 for one year. It seems permissible to include for our consideration all the cases, because we are concerned only with the question of the pathologic differentiation of radiosensitive and radioresistant tumors and not with their radiocurability. Moreover, it has been our experience that a recurrence after radiotherapy occurs most frequently within the first year. Similar experiences have been

6. Duval, R., and Lacassagne, A.: Classification pratique des cancers dérivés des épithéliums cutanés et cutanéo-muqueux, Paris, G. Doin, 1922.

mentioned also by Coutard [7] and by Schinz and Zuppinger,[8] who find recurrence rare if the patient has remained well for one year.

A classification of our material according to the location (table 2) did not furnish much information because of the small number of cases. There is no evidence in our study that one location is more favorable than another. Our information as to the macroscopic appearance of the tumors was too meager to permit any comment. It is evident, however, that the smaller neoplasms will react better than the larger ones.

A survey of the cases arranged according to the degree of differentiation of the carcinoma cells (table 3) shows that the majority belong to the epidermoid or an intermediary type. This finding is in accordance with the experience of other investigators. The ratio of differentiated

TABLE 2.—*Classification of Thirty-Two Carcinomas of the Larynx According to Location and Results of Treatment with Roentgen Rays*

	Success	Failure
Epiglottis	6	3
Vocal cords	12	4
Subglottic region	..	..
Extensive or extrinsic	3	4

TABLE 3.—*Classification of Thirty-Two Carcinomas of the Larynx According to the Degree of Histologic Differentiation and Results of Treatment with Roentgen Rays*

Grade	Success	Failure
1	6	3
2	9	5
3	4	4
4	1	..

laryngeal cancers to undifferentiated types according to Broders [5] was 56 per cent to 44 per cent; Schinz and Zuppinger [8] estimated nearly 70 per cent to 30 per cent, and our figures on 60 cases are 80 per cent to 20 per cent. Table 3 illustrates the distribution of the growths in our cases into the four groups according to Broders' classification. It is evident from this table that there is no difference in the response to radiotherapy between the differentiated and the less differentiated types of carcinoma.

We have studied the frequency of mitoses in order to determine whether there was a relationship to the degree of radiosensitivity. In table 4, "rare" refers to growths in which less than 1 mitotic figure was found per high dry magnification in an average of 10 fields, while

7. Coutard, H.: Roentgentherapy of Epitheliomas of the Tonsillar Region, Hypopharynx and Larynx from 1920 to 1926, Am. J. Roentgenol. **28**:313, 1932.

8. Schinz, H. R., and Zuppinger, A.: Siebzehn Jahre Strahlentherapie der Krebse, Leipzig, Georg Thieme, 1937.

"frequent" indicates 1 or more mitotic figures under the same conditions. The tabulation seems to indicate that the tumors with frequent mitoses react more favorably than those in which nuclear division is rarely found.

A classification of our material was made according to atypism of the individual cells, especially of the nuclei (table 5). We looked particularly for monstrosities in size and shape (fig. 5), atypical mitoses (fig. 6), multinucleosis and nuclear hyperchromatism. A certain minor degree of irregularity involving a few cells only was accepted as insignificant, but more striking atypism was recorded. No conclusions could be drawn from this cytologic feature of the neoplasms.

Finally the degree and type of inflammatory reaction in the stroma were assayed, but no conclusions could be drawn; the type and intensity

TABLE 4.—*Classification of Thirty-Two Carcinomas of the Larynx According to the Frequency of Mitoses and Results of Treatment with Roentgen Rays*

	Success	Failure
Rare	6	7
Frequent	14	5

TABLE 5.—*Classification of Thirty-Two Carcinomas of the Larynx According to Cell Anaplasia and Results of Treatment with Roentgen Rays*

Anaplasia	Success	Failure
Absent	8	3
Present	12	9

of reaction did not bear any relationship to the sensitivity of the tumor toward radiotherapy.

Our observations tend to show that there are no pathologic criteria, except possibly for the number of mitoses, which permit of a differentiation between radiosensitive and radioresistant laryngeal carcinoma if protracted fractional roentgen therapy is used. This conclusion seems to contradict the accepted belief that radiosensitivity depends to a great extent on the degree of differentiation of the tumor cells. In view of this discrepancy we have reviewed the literature for the purpose of finding reports which might correlate the histologic picture of laryngeal carcinoma with the effect of protracted radiotherapy. Unfortunately, few detailed reports are available. Lenz [2] and Lenz, Coakley and Stout,[9] who used roentgen therapy with a modification of Coutard's principles,

9. Lenz, M.; Coakley, C. G., and Stout, A. P.: Roentgentherapy of Epitheliomas of the Pharynx and Larynx, Am. J. Roentgenol. **32**:500, 1934.

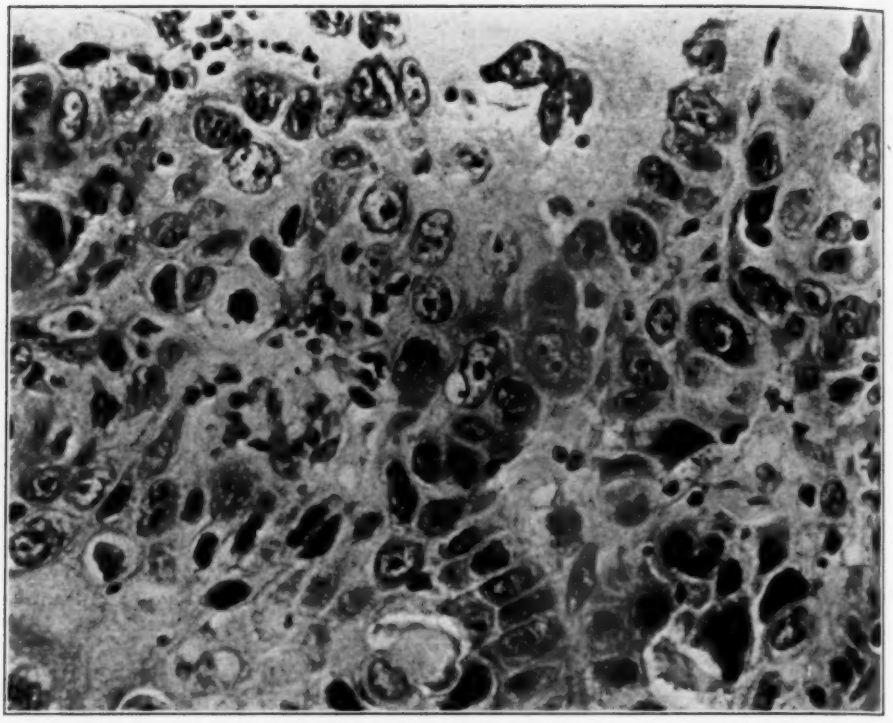

Fig. 5.—Mature squamous cell carcinoma of type 2 with striking atypism of the cells, on the epiglottis. The patient was treated in the spring of 1935 and died in 1936.

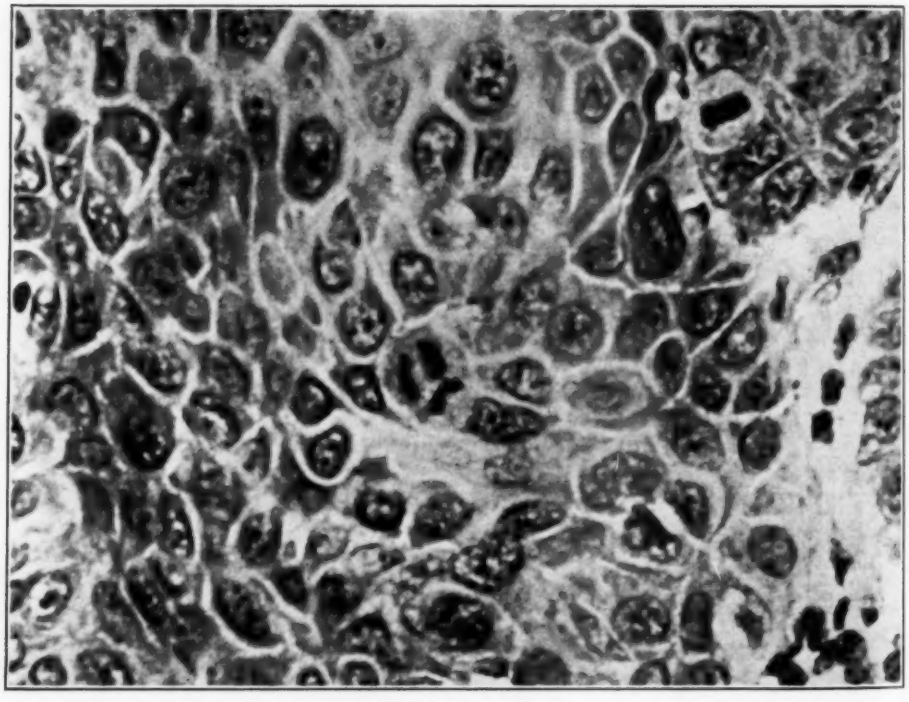

Fig. 6.—Mature squamous cell carcinoma of type 1 with tripolar mitosis, involving the right vocal cord and part of the left. The patient was treated in the summer of 1932 and died in January 1934.

stated that keratinized carcinomas of the larynx are radioresistant. Yet Stout [10] in discussing cancers of the oral cavity and of the upper parts of the respiratory tract found "a large proportion of sensitive tumors among the cases with the greatest amount of keratin and the greatest number of bridges and pearls." He expressed the belief that such tumors can be destroyed only if they are small—2 cm. or less in diameter—and easily accessible. Unfortunately, he did not indicate where these tumors were located.

The reports at the last international congress for otolaryngology, however, tended to support our point of view. Schinz and Zuppinger [8] reported favorable results in 25 hornifying and 10 less differentiated squamous cell carcinomas of the larynx but did not further correlate the histologic picture of the tumors with the result of radiotherapy. Vogel,[11] as well as Adam, however, stressed the view that a histologic differentiation of radiosensitive and radioresistant laryngeal carcinomas is impossible. Adam [12] concluded "that the choice of treatment should be decided by the anatomic extent and the clinical impression while the histologic structure of the epitheliomas of the inner larynx is of minor importance." Kriegsmann [13] stated that the histologic analysis does not permit of a differentiation between radioresistant and radiosensitive carcinomas. Quick [14] also limited the importance of histologic examination in the indication for the type of treatment in laryngeal cancer.

SUMMARY AND CONCLUSIONS

Thirty-two patients with carcinoma of the larynx were treated with roentgen rays according to the principles of Coutard. Biopsy material was studied histologically to determine criteria for a pathologic differentiation of radiosensitive and radioresistant neoplasms.

Grade of cellular differentiations, mitotic count, anaplasia of the cells, reaction in the stroma and location of the neoplasms were carefully considered, but no clearcut criteria could be established.

It is concluded that for protracted roentgen therapy the histologic structure is of minor importance in determining the radioresistance of laryngeal carcinomas.

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10. Stout, A. P.: Factors Influencing the Determination of Radiosensitivity of Cancers of the Oral Cavity and Upper Respiratory Tracts, Am. J. Roentgenol. **33**:327, 1925.

11. Vogel, K.: Die Strahlenbehandlung des Kehlkopfcarcinoms, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:172, 1937.

12. Adam, A.: Technik und Methodik der Strahlenbehandlung des Larynx-Carcinoms, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:192, 1937.

13. Kriegsmann: Demonstration von röntgenbestrahlten Kehlkopfkarzinomen, Hals,- Nasen- u. Ohrenarzt (Teil 2) **44**:242, 1937.

14. Quick, D.: Carcinoma of the Larynx, Am. J. Roentgenol. **38**:821, 1937.

HEMOLYTIC STREPTOCOCCUS MENINGITIS OF OTITIC ORIGIN

REPORT OF A RECOVERY

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Otitic meningitis, an infection of the cerebrospinal fluid system, is comparable to otitic sepsis, an infection of the blood stream. Nature attempts in both conditions to localize the infection by erecting protective barriers which tend to limit the bacteria to the area of initial involvement. Finally, when nature unaided is insufficient to prevent a general invasion, the bacteria circulate freely in the blood stream or in the cerebrospinal fluid system. This results in general sepsis, with a noticeable reduction in the number of recoveries, or in suppurative meningitis, with few recoveries. Here the end result widens the comparison tremendously and gives significance to the need of adopting toward otitic suppurative meningitis a definite surgical attitude, similar in principle to that generally taken toward otitic sepsis.

Formerly, when meningitis occurred during otitic infection, there was often undue delay before the primary focus was eliminated. Now the mastoid infection is exenterated as soon as possible. When meningitis supervened after a mastoidectomy neither the otologist nor the neurologist thought it advisable to revise the mastoid wound and search for a possible macroscopic path of invasion of the infection from the mastoid to the dura. Now the temporal bone is explored as freely as possible. Further surgical treatment of the condition has not many exponents.

INCISION OF THE DURA IN MENINGITIS

Eagleton[1] stated that clinically otitic meningitis, in a large proportion of cases, passes three stages:

1. The stage of invasion of the subarchnoid meshes, during which the symptoms of meningitis are more or less definite. The spinal fluid has a high cell count and an increased content of globulin.

Read before the Morrisania City Hospital Clinical Society, Jan. 26, 1938.
From the Otolaryngologic Service of Dr. G. B. Gilmore, Morrisania City Hospital.

1. Eagleton, W. P.: Otitic Meningitis, J. A. M. A. **87**:1544 (Nov. 6) 1926.

2. The stage of pia-arachnoid localization, during which the infection is limited by a walling-off process. The spinal fluid may be of increased or normal pressure and has a low cell count.

3. The terminal stage, or the stage of generalized suppurative meningitis.

In the first two stages cultures of the spinal fluid are sterile and the condition in these stages is classified as protective meningitis. In the third stage cultures are positive.

Eagleton operates while the inflammation is limited to an area adjacent to the primary focus of infection or to an adjacent basal cistern. Evacuation [2] of the infected cerebrospinal fluid while the infection is localized has enabled him to secure recovery in about 32 per cent of his cases.

Actually, this means incision of the dura for drainage in the case of serous, protective or sympathetic meningitis.

Shambaugh Jr.[3] advised against incising the dura for protective meningitis. He, however, advocated surgical drainage of the basilar cisterns when the culture is positive. Acting on this principle, he obtained 5 consecutive recoveries from protective and suppurative meningitis.

The gap between these two views is filled by the opinions of those who eradicate the primary focus and rely on spinal puncture and, recently, the use of para-amino-benzene-sulfonamide and its derivatives. Without this drug the results were mostly fatalities. With this drug the results are hopeful. As yet there has been no report of a series of cases in which the condition was treated with this drug; hence, there is no basis for estimating the percentage of recoveries.

THE PETROUS PYRAMID IN MENINGITIS

The literature contains ample evidence pointing to the petrous pyramid as one of the gateways for infection of the meninges. The spread occurs most frequently by thrombophlebitis or by direct extension through necrosis of the superior or posterior surface of the petrous pyramid, with the formation of an extradural abscess, which if not drained will cause meningitis.

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2. Eagleton, W. P.: Suppurative Meningitis of Otitic and Nasal Origin: Its Relation to Blood Stream Invasion of the Pial Vessels, Arch. Otolaryng. **15**:885 (June) 1932.

3. Shambaugh, G. E., Jr.: The Surgical Treatment of Meningitis of Otitic and Nasal Origin, J. A. M. A. **108**:696 (Feb. 27) 1937.

Smith [4] reported several cases of extradural abscess of the superior surface of the petrous pyramid. Drainage of the abscess resulted in recovery. He concluded that fatal meningitis may originate with petrositis.

Friesner and Druss [5] by histologic studies traced routes of infection through the petrous pyramid to the meninges. In each case, symptoms of meningeal irritation preceded meningitis by a considerable period. These observers advised exploration, with an approach to the petrous tip, if progressive signs of meningeal irritation are present.

Cassady [6] and Profant [7] each reported a number of cases of meningitis secondary to petrositis.

Autopsy reports show that with infection of the petrous pyramid, extradural abscess and meningitis are the most common observations.[8] They show also that the petrous pyramid may be overlooked as a focus of infection because a greatly diseased petrous pyramid may appear normal on macroscopic inspection.[9]

The most conclusive evidence of the importance of the petrous pyramid in the causation of meningitis and its prevention is the report of cases of petrositis by Kopetzky and Almour.[10] Their work seems to indicate that meningitis secondary to petrositis is preventable.

THE LABYRINTH IN MENINGITIS

Suppurative labyrinthitis causing meningitis by invasion of the posterior cranial fossa is not new and is too well known to stress. This applies also to its symptoms, diagnosis, surgical treatment and paths of invasion.

It is apparent that the petrous pyramid plays a dominant role in otitic meningitis. Petrositis occurs much more frequently than does suppurative labyrinthitis and is, therefore, more often the cause of meningitis. The surgical technic for the drainage of infections of

4. Smith, C. H.: Infections of the Petrous Pyramid, West Virginia M. J. **28**:7 (Jan.) 1932; "Petrositis," New York State J. Med. **36**:983 (July 1) 1936.

5. Friesner, I., and Druss, J. G.: Osteitis of the Petrous Pyramid of the Temporal Bone, Arch. Otolaryng. **12**:342 (Sept.) 1930.

6. Cassady, J. V.: Otitic Meningitis, Arch. Otolaryng. **16**:176 (Aug.) 1932.

7. Profant, H. J.: Gradenigo's Syndrome, with a Consideration of "Petrositis," Arch. Otolaryng. **13**:347 (March) 1931.

8. Courville, C. B., and Nielsen, J. M.: Fatal Complications of Otitis Media, with Particular Reference to the Intracranial Lesions in a Series of Ten Thousand Autopsies, Arch. Otolaryng. **19**:451 (April) 1934.

9. Eggston, A.: Pathways of Infection in Suppurative Meningitis, Ann. Otol., Rhin. & Laryng. **43**:672 (Sept.) 1934.

10. Kopetzky, S. J., and Almour, R.: The Suppuration of the Petrous Pyramid: Pathology, Symptomatology and Surgical Treatment, Ann. Otol., Rhin. & Laryng. **40**:922 (Sept.) 1931.

the petrous pyramid is now as well established as that for the drainage of infection of the labyrinth. Infections of the petrous pyramid and of the labyrinth lend themselves to premeningitis therapy.

VALUE OF DECOMPRESSION

In a wide exposure of the dura one is more apt to find or to rule out an extradural abscess or the thickened discolored dura of localized pachymeningitis, beyond which there may be a subdural abscess. If an extradural abscess or evidence of a subdural abscess is not found, one has at least broken off the venules running from the mastoid to the dura. The limiting plates, though normal in appearance, may be osteitic. By the removal of these plates osteothrombophlebitic foci are perhaps destroyed, and a possible path of invasion to the meninges is closed.

REPORT OF CASE

R. Z., a boy aged 6 years, was admitted to the Morrisania City Hospital on Nov. 17, 1937, at 11 p. m.

History.—The illness began about November 1, with a nasal discharge and a low temperature, followed by pain in the right ear and a rise in temperature. The right ear drum ruptured spontaneously a week later, and the temperature became lower. The ear discharged for a week. The temperature did not return to normal. When the aural discharge stopped, the child complained of pain in the head, most pronounced in the frontal region and worse at night. He became constipated, and he had abdominal pain. Three days before admission he complained of earache on the left side. The pain in the head and in the abdomen became more severe, and the temperature rose to 105.5 F. His neck became stiff, he was drowsy, and he vomited two or three times a day during the next three days. He would not take solid food, and he vomited all fluids. During this entire illness he did not have medical care. Dr. Sarah Salant Rifkin saw him on the evening of his admission to the hospital. His temperature was 105.8 F.

The child had measles at the age of 3 and whooping cough and chickenpox at the age of 5. The mother absolutely denied that he had had any previous aural infection.

Physical Examination.—The patient appeared acutely ill. His cheeks were flushed, he was drowsy, his head was extended and his neck was rigid. A positive Kernig sign and an equivocal Brudzinski sign were present. The lungs were clear. There was tachycardia, with a soft systolic murmur at the apex. The pulse rate was 122, the respiratory rate 24 and the temperature 103.2 F. The abdomen was distended but not tender. The pharynx was injected; the tonsils were hypertrophied. There was a slight mucoid nasal discharge. Except for redness along the malleus, the left ear drum was normal. There was no discharge from the right ear. The anterior portion of the ear drum was flat and gray; posteriorly the drum showed moderate fulness and congestion. There was no mastoid tenderness or infiltration.

Spinal tap showed an initial pressure of 16 mm. of mercury. The pressure dropped to 8 mm. on the withdrawal of 15 cc. of cloudy fluid. There were 3,000 cells per cubic centimeter; sugar was absent; the globulin content was increased. A culture was made, and Streptococcus haemolyticus was observed.

Operation.—Mastoidectomy on the right side was done at 2 a. m., three hours after admission. The operation consisted of widely exenterating the mastoid structures (including limiting plates of bone) and exposing the dura of the middle and the posterior cranial fossas and the sigmoid sinus. This included exposure of the dura under Trautman's triangle to the posterior semicircular canal. Because of an inadvertent tear in the sigmoid sinus the petrous pyramid was not explored.

Pathology.—The mastoid was sclerotic except near the mastoid tip and Trautman's triangle, where granulations were found. When these areas were exposed there was an escape of mucopurulent exudate under pressure. The aditus was constricted by sclerosis. There was no granulation tissue in the aditus. There was no flow of exudate from the middle ear. The exposed dura and the sinus were normal in appearance. The dura of the middle cranial fossa felt tense on palpation. In view of the mother's insistent denial of a previous infection of the ear, the sclerosis was assumed to be new bone formation, nature's attempt to heal the mastoid lesion. Subsequent roentgen examination of the left mastoid disclosed a highly pneumatized process.

Laboratory Data.—The urine was normal throughout the patient's stay in the hospital. On November 18 there were 15,000 leukocytes, of which 83 per cent were polymorphonuclears and 3 per cent were transitional cells. On November 21 a blood count showed 2,700,000 erythrocytes and a hemoglobin content of 60 per cent. There were 14,350 leukocytes, with 81 per cent polymorphonuclears and 3 per cent transitional cells. On November 24 there were 2,760,000 erythrocytes and a hemoglobin content of 60 per cent. The leukocyte count was 12,450, of which 78 per cent were polymorphonuclears and 5 per cent were transitional cells. On December 1 a blood count showed 4,840,000 red cells and a hemoglobin content of 70 per cent.

A blood culture taken on November 18 was sterile. A culture of material taken from the mastoid yielded Str. haemolyticus.

The patient had nine spinal taps, of which the first three yielded Str. haemolyticus. The greatest spinal pressure was 26 mm. of mercury. The highest cell count was 3,000.

Treatment and Course.—On November 17, a half hour after admission, the patient received 5 cc. of prontosil [11] intramuscularly. The dose was repeated six hours later.

On November 18 the child was more alert, restless and irritable. The neck was moderately rigid. The Kernig sign was present. The temperature ranged between 101 and 103.8 F. Twenty grains (1.3 Gm.) of sulfanilamide was given orally. Two spinal taps were done, and 25 cc. of cloudy fluid was removed. The cell count was 3,000 on the first and 1,800 on the second tap. The spinal fluid showed a sugar content of 40.5 mg., and a chloride content of 678 mg.

On November 19 the patient's condition was unchanged. The temperature varied between 99.4 and 103.2 F. The average pulse rate was 120. Twenty grains of sulfanilamide was given in four divided doses. Two spinal taps were done. Twenty-three cubic centimeters of cloudy fluid was removed, and 17 cc. of an 0.8 per cent solution of sulfanilamide was introduced intraspinally by the gravity method.[12]

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11. The name prontosil has been applied to several different preparations. The one that I used was the disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3,′ 6′-disulfonic acid.

12. Schwentker, F. F.; Solomon, S., and Long, P. H.: The Treatment of Meningococcic Meningitis with Sulfanilamide, J. A. M. A. **108**:1407 (April 24) 1937.

A transfusion of 150 cc. of blood was given because of the anemia and weakness of the patient.

On November 20, the child was more alert. The temperature varied from 98.6 to 102 F. He was taking more fluids. Twenty grains of sulfanilamide was given. A spinal tap was done; 8 cc. of almost clear fluid was withdrawn, and 5 cc. of 0.8 per cent solution of sulfanilamide was introduced. The spinal fluid contained 200 cells and 52.5 mg. of sugar.

On November 21 rigidity of the neck was slight; the Kernig sign was practically absent; the general condition was much improved. He took nourishment well. The temperature varied between 98.6 and 101.2 F. The average pulse rate was 110. Twenty grains of sulfanilamide was given by mouth. One spinal tap was done; 15 cc. of almost clear fluid was withdrawn, and 10 cc. of 0.8 per cent solution of sulfanilamide was introduced. The spinal fluid contained 80 cells; the sugar content was 43.8 mg.; the chloride content was 702 mg.

On November 22 the child appeared bright and was playful. The neck was only slightly rigid. The temperature ranged from 98.6 to 99.6 F. He ate well. Twenty grains of sulfanilamide was administered. Fifteen cubic centimeters of spinal fluid was removed, and 10 cc. of solution of sulfanilamide was introduced.

On November 23 the child was playful and sat up. The temperature varied from 98.6 to 99.8 F.; the pulse rate was 96. Twenty grains of sulfanilamide was again given. Then 10 grains (0.65 Gm.) of sulfanilamide was given every day until November 29. A lumbar puncture was done, and about 5 cc. of clear fluid under normal pressure was withdrawn. Because the temperature had been below 100 F. for thirty hours and all signs of meningeal irritation had disappeared, the intraspinal administration of sulfanilamide was discontinued. No more spinal taps were made.

On November 24, at midnight, the child had a hemorrhage from the sigmoid sinus and lost about 200 cc. of blood. The bleeding stopped spontaneously. A pressure bandage was applied. On that morning the child was given a light anesthetic and the wound was inspected. Since there was no bleeding, a loose dressing was inserted in the mastoid cavity.

On November 26 a transfusion of 200 cc. of blood was given to replace the loss by hemorrhage and to prevent the impairment of the patient's resistance. From that date he made an uneventful recovery. He was discharged from the hospital December 4. The wound was completely healed by Jan. 1, 1938.

SUMMARY

When headache and vomiting occur during the course of an aural infection, an intracranial involvement, probably meningitis, should be suspected.

When otitic sepsis is due to involvement of the sigmoid sinus, the primary focus being in the blood stream, the infected sinus should be incised and its contents evacuated. In the case of otitic suppurative meningitis with the primary focus in the cerebrospinal fluid system, the nearest collection of cerebrospinal fluid should be evacuated by an incision of the dura, at least when the localized process or path of invasion is recognized.

To maintain the resistance of the patient and to prevent a generalized spread of the bacteria, the initial lesion should be removed early, and

supportive therapy should be instituted before nature's barriers are broken down.

In treating septic meningitis, Eagleton and Shambaugh Jr. resort to surgical drainage by incision of the dura adjacent to the initial focus. With the use of sulfanilamide in conjunction with dural incision it is reasonable to expect a greater percentage of recoveries.

In the elimination of the mastoid lesion, all limiting bone plates should be removed from the zygoma anteriorly, to and beyond the sinus posteriorly. This procedure destroys possible foci of osteothrombophlebitis and enables the surgeon to make a wide inspection of the dura.

The signs and symptoms of petrositis (whether they are receding or progressing) [13] and the surgical approaches to the petrous pyramid should be known by otologists.

Suppurative labyrinthitis and petrositis have great importance in premeningitis therapy.

Sulfanilamide, as used intraspinally in the case reported, had no irritating effect on the meninges.

1749 Grand Concourse.

13. Almour, R.: Differentiation Between Receding and Progressing Cases of Petrositis, New York State J. Med. **37**:1495 (Sept. 1) 1937.

SPONTANEOUS HEMORRHAGE INTO THE MAXILLARY SINUS

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Spontaneous hemorrhage into the maxillary sinus is a relatively rare condition, recognized only by methodic studies in the presence of epistaxis. In our search through the literature we have found but two references [1] to the condition in the last ten years, and in personal communication with seven outstanding rhinologists [2] in 1933, we learned that only one of them [2d] had observed it in his long experience and that he had treated it only twice. We found no mention of the condition in the books published by Gradle,[3] Bishop,[4] Thomson,[5] McKenzie,[6] Hajek,[7] Ballenger and Ballenger,[8] Phillips,[9], Loeb,[10] Jackson, Coates and Jackson [11] and Skillern.[12]

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1. (*a*) Bass, A. L.: Primary Hemorrhage from Antrum of Highmore, South. M. J. **29**:815 (Aug.) 1936. (*b*) Mayoux, R.: A Bleeding Polyp of the Maxillary Sinus Causing Epistaxis: Report of a Case, Lyon méd. **151**:674 (May 28) 1933.

2. (*a*) Jackson, Chevalier: Personal communication to the authors. (*b*) Mosher, Harris P.: Personal communication to the authors. (*c*) Shambaugh, George E.: Personal communication to the authors. (*d*) Shea, John J.: Personal communication to the authors. (*e*) Mithoefer, William: Personal communication to the authors. (*f*) Ballenger, H. C.: Personal communication to the authors. (*g*) McCready, J. H.: Personal communication to the authors.

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10. Loeb, H. W.: Operative Surgery of the Nose, Throat and Ear, St. Louis, C. V. Mosby Company, 1924.

(Footnotes continued on next page)

We believe that with this background we are justified in the preparation of an article on the condition in an effort to establish the symptoms and proper treatment for a lesion which may be too radically approached, owing to a lack of literature outlining subsequent events. For that reason our own treatment was too radical with our early patients.

BLOOD SUPPLY

Phillips [9] stated that the blood supply of the antrum is derived from the vessels of the nasal mucosa which pass through the ostium maxillare and from some collateral branches of the vessels of the lateral nasal wall which pass through the bone to the inner antral wall.

Loeb [10] noted that the arteria alveolaris superior, the arteria alveolaris posterior and the arteria infraorbitalis supply the mucosa of the maxillary sinus and the periosteum of the maxilla.

Gray [13] stated that the posterior alveolar artery (arteria alveolaris superior posterior; alveolar or posterior dental artery) is given off from the internal maxillary artery, frequently in conjunction with the infraorbital artery just as the trunk of the vessel is passing into the pterygopalatine fossa. Descending on the tuberosity of the maxilla, it divides into numerous branches, some of which enter the alveolar canals to supply the molar and premolar teeth and the lining of the maxillary sinus while others are continued forward on the alveolar process to supply the gums.

The infraorbital artery (arteria infraorbitalis) appears, from its direction, to be the continuation of the trunk of the internal maxillary artery, but it often arises in conjunction with the posterior superior alveolar artery. It runs along the infraorbital groove and canal with the infraorbital nerve and emerges on the face through the infraorbital foramen, beneath the infraorbital head of the quadratus labii superioris muscle. While in the canal it gives off (*a*) orbital branches, which assist in supplying the rectus inferior and obliquus inferior muscles and the lacrimal sac, and (*b*) anterior superior alveolar branches, which descend through the anterior alveolar canals to supply the upper incisor and canine teeth and the mucous membrane of the maxillary sinus.

The sphenopalatine artery (arteria sphenopalatina; nasopalatine artery) passes through the sphenopalatine foramen into the cavity of the nose, at the back part of the superior meatus. Here it gives off its posterior lateral nasal branches, which spread forward over the conchas

11. Jackson, C., and Coates, G. M.: Nose, Throat and Ear and Their Diseases, Philadelphia, W. B. Saunders Company, 1929.

12. Skillern, R. H.: Catarrhal and Suppurative Diseases of the Accessory Sinuses of the Nose, ed. 4, Philadelphia, J. B. Lippincott Company, 1923.

13. Gray, H.: Anatomy of the Human Body, edited by W. H. Lewis, ed. 20, Philadelphia, Lea & Febiger, 1918, pp. 561-562.

and meatuses, anastomose with the ethmoid arteries and the nasal branches of the descending palatine artery and assist in supplying the frontal, maxillary, ethmoid and sphenoid sinuses.

The point of entry is not given in any of these texts for the vessels supplying the interior of the antrum.

CAUSES

We have observed 12 patients with spontaneous maxillary hemorrhage over a period of ten years. Five of these were women and 7 were men. The ages ranged from 31 to 66. The right antrum was involved in 5 and the left in 7 instances. Hemorrhage did not occur bilaterally in any instance. Hemophilia was not present in any of the men, and there was no vicarious menstrual history for any of the women. The patients were all American born. No history was obtained which would indicate trauma, such as violent blowing of the nose or direct injury, nor were there other inciting factors evident. The blood pressure in all patients was within the accepted normal. In each instance a roentgenographic lesion was demonstrated, and in the patients who were operated on this lesion was of a hyperplastic character.

Indirect trauma must be remembered as a possible inciting cause, but in 10 of the 12 cases a preexisting, or at any rate a coexisting, hyperplastic maxillary sinusitis was proved. It is well known that new capillaries occur in some cases of hyperplastic disease [1b] of the maxillary sinus, but we are convinced that in this series there must have been a gross lesion of one of the major antral vessels. The hemorrhage suffered by these patients was too severe and persistent to have come from a minor capillary bed. No tuberculosis, malignant process, ulcer, syphilis or physical rent was observed to account for the condition. We suggest that it may be an occasional complication of hyperplastic disease of the maxillary sinus. Certainly, if the gross and the microscopic details are to be respected, our conclusions are justified on the basis of these studies.

SYMPTOMS

Burning pain was constantly noted by each patient during active bleeding. The discomfort was located in the inner canthal region of the eye on the involved side, and there was a feeling as though the bleeding were actually in that eye; there was also a peculiar burning, itching and tickling sensation high in the nose on the side of the bleeding.

Sudden and expulsive hemorrhage of bright red blood ceased abruptly only to start again forcefully, without any apparent reason. Our observation of this symptom suggests that a blood clot occludes the ostium or ostia sufficiently to control bleeding until the antrum again fills with blood and enough pressure is exerted within the antrum to dislodge the obstruction. Periods between hemorrhages may vary from

a few minutes to several hours. Peculiarly, shrinkage of the mucous membrane and of the turbinates followed by fairly energetic negative pressure endonasally failed to induce hemorrhage in a single instance.

Studies of the blood gave negative results except for a decrease in the hemoglobin and in the red blood cells. The Wassermann reaction was negative in all cases.

Roentgen examination gave positive indication of alteration in each case. The opacity in each instance represented that observed with a hyperplastic lesion of the maxillary sinus.

Antral lavage yielded positive results in all cases. The lavages returned black fragmented clots or dark red coagula, characteristically. We did not observe any organization in these clots. No macroscopically visible pus was seen in any of the washings.

Endonasal studies are particularly valuable. The only characteristic finding is evidence of active bleeding from the middle meatus on the involved side.

PATHOLOGIC PICTURE

The gross pathologic change is best described by citing one of the typical records of the pathologic conditions found at operation.

> Immediately on the opening of the canine fossa, blood clots were seen; these were cleansed away before a visualization of the structure was possible. The entire mucous membrane was found to have undergone mild hyperplastic changes, especially in the anterior two thirds of the right periphery. However, the entire mucous membrane, beginning at the posterior middle portion, stripped up as one mass of tissue, and it could be reconstructed after delivery through the canine fossa. There were many areas, ranging from 3 to 5 mm. in diameter, that were hard, raised, grayish white and fibrotic. These peculiar islets were unusual and suggestive of unusual pathologic change. Tissue was taken and referred to Dr. Fenton for diagnosis. The hemorrhage was found to be coming from the area of the anterior inferior angle at about the level of the floor of the nose and about 1.5 cm. back of the nasoantral angle; it was controlled immediately on removal of the hyperplastic membrane.

The hemorrhage was found to be springing from the roof anteriorly in one case, from the floor anteriorly along the nasoantral wall in a second and from the floor anteriorly in a third. The point of hemorrhage was not observed in any of the other patients who were operated on. It is significant, however, that grossly all those patients had a clean antrum except for products of hemorrhage and typical hyperplastic changes. One patient did have an area in the mucous membrane suggestive of a malignant lesion.

Microscopically no marked alteration was noted other than those routinely observed in hyperplastic mucous membrane previously studied in our practice. The pathologist's report follows:

> The ciliated columnar epithelium is somewhat hyperplastic and papillary. The stroma is loose and edematous. The mucous glands show cystic changes, but

the tissue appears somewhat necrotic. One large area is seen containing an amorphous necrotic locus. There is an infiltration of lymphocytes, plasma cells and eosinophils into the stroma.

TREATMENT

On 10 of the 12 patients with spontaneous maxillary hemorrhage observed in our practice we performed an external radical operation on the antrum; 2 patients were not operated on. All patients were carefully studied, by means of general physical examination, routine study of the blood and the Wassermann test, in an effort to determine if possible a basis for hemorrhage distal to the bleeding antrum. The first 10 patients were operated on to control hemorrhage and to obtain an accurate pathologic picture, as we were concerned in each instance with the possibility of a malignant lesion. Two patients were not operated on, since bleeding was controlled by antral lavage and did not recur.

RESULTS

In the 10 cases in which an operation was performed, bleeding was immediately controlled, and but 1 patient has had any further difficulty since convalescence. The recovery of patients who were operated on was not materially different from that of patients subjected to the usual routine Caldwell-Luc procedure. The 2 patients who were not operated on responded nicely to irrigation, and over a period of twenty-six and eight months, respectively, neither of them has had any further difficulty. We are now convinced that if the literature had been sufficiently clear we could have avoided radical surgical intervention in all but 1 of the cases in which we operated. In this case the hemorrhage was so severe that the patient's hemoglobin was down to 58 per cent.

SUMMARY AND CONCLUSIONS

Spontaneous hemorrhage from the maxillary sinus does occur as a complication of hyperplastic maxillary sinusitis.

It occurred in 1 patient in 1,400 in our practice.

No underlying general systemic or vascular disease was found concurrent or coexistent with the hemorrhage.

It would seem that in all cases of a similar nature an operation which has as its purpose control of the hemorrhage, complete inspection of the endoantrum and the obtaining of all contained tissue for microscopic section is a rational procedure; however, in 2 of our cases this operation was not done and clinical results so far are optimal.

An attempt has been made to present the symptoms and to outline a rational method of therapy.

Empire Bank Building.

LYMPHOEPITHELIOMA

(SCHMINCKE TUMOR)

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SAN FRANCISCO

Lymphoepithelioma of the mesenchymal tissue is exceedingly rare. However, the clinician is occasionally confronted with this condition, whose early recognition and prompt irradiation are essential for a cure. In 1921 Reverchon and Coutard reported from Regaud's Clinic a neoplasm of the hypopharynx, and independently in the same year Schmincke reported a series of cases. The name given by them to the condition was derived from the fact that the tumor appears to arise from organs in which there is abundant lymphocytic infiltration of the submucosa. The primary growth is, therefore, not necessarily limited to the tonsils or to the nasopharynx but may be found wherever there are lymphoid collections. The thymus gland belongs embryologically to the same group of lymphoepithelial organs, and neoplasms of similar structure in this gland have been recorded by various investigators (Symmers and Vance, Herriman, and Rahte, Laas and Wu). In the past sixteen years nearly 150 cases have been reported (see bibliography). In the majority of these the primary growth was located in the first part of the respiratory and alimentary tracts, but on reviewing the literature one receives the impression that a great many of these tumors were not lymphoepitheliomas but reticulomas or other more common forms of neoplasm. It is the purpose of this paper not only to report 5 cases but to give a complete review of the literature for the benefit of the otolaryngologist. This is the first time such a review has been given in English.

During the past eighteen months 2 patients with lymphoepithelioma, whose cases are reported, came under my observation at the Rudolph Hospital in Vienna (Prof. Dr. Erich Ruttin). In order not to increase the literature and at the same time to make the paper more complete, I am also including 3 cases observed in San Francisco.

REPORT OF CASES

CASE 1.—K. J., a workman aged 58, was admitted to the ear, nose and throat department of the Rudolph Hospital complaining of a scratchy sensation in his throat, which he had noticed for the past four weeks. He had difficulty and pain on swallowing. In spite of gargling he was bothered with fetor from the mouth. His general condition was good.

Examination disclosed a moderate amount of trismus. No teeth were present. The left tonsil was normal; the right tonsil, being enlarged, extended to the uvula and was firm and nonfluctuant. Its posterior surface was partially necrotic. The patient's general condition was normal except for senile changes and the presence of moderate anemia with a relative lymphopenia; the thrombocytes were slightly diminished in number, although not much below normal. The Wassermann test was negative.

Treatment.—A week later a tonsillectomy was performed (by Professor Ruttin). The excision extended a considerable distance into the surrounding tissue. A piece of the anterior palatine arch was also excised. A few days after the receipt of a histologic report that the lesion was malignant, a cervical resection was performed (by Professor Ruttin), and all glands which were small and soft were removed, together with a great deal of adipose tissue. The treatment was continued by irradiation (Prof. Dr. Schönbauer); 78,000 milligram hours were given to the right side of the neck and the tonsillar region over a period of six months. Approximately one year later the patient was well and showed no exacerbation of the primary tumor, nor were there any metastases.

Pathology.—Histologic examination (Professor Priesel) of that portion of the tonsil which was not necrotic showed accumulations of proliferating reticulum cells having large pale nuclei, between which were a huge number of round cells. The round cells were more closely associated with the primitive vessels. The necrotic area was infiltrated by clumps of bacteria. Microscopic examination of the cervical glands showed no neoplastic tissue. The results of the examination indicated the presence of a lymphoepithelioma.

Case 2.—M. A., a housewife aged 53, came to the ear, nose and throat clinic complaining that she had had for the past several weeks a sensation of a foreign body in the left part of her throat, "as if a mucus plug was hanging down." She had no pain or difficulty in swallowing. A week later, while inspecting her throat, she became worried when she noticed a strawberry-like mass protruding from the left tonsil, and this resulted in her present visit to the clinic.

When a child, the patient frequently had sore throat. At the time of her admission the examination showed a moderately senile woman who appeared somewhat emaciated. There was no trismus. The teeth were carious. The right tonsil was normal and atrophic. A red mass of about 1 cc. in volume protruded from the left tonsil. Both tonsils felt hard on palpation. There was no ulceration. Her general condition appeared good except for relative lymphopenia. The Wassermann test was negative. There was no adenopathy.

Treatment.—One week later the left tonsil was removed (by Professor Ruttin), and the surrounding tissue appeared normal. The bed of the tumor was irradiated from the bottom. The neck was also exposed to a radium cannon (by Professor Schönbauer). After one year the site of the primary neoplasm contained what appeared to be some scar tissue. There were no metastases.

Histologic Examination (Professor Priesel).—The normal tissue was replaced by a uniform structure of proliferating reticulum cells, the nuclei being poor in chromatin, but containing clearly distinguishable nucleoli. Many karyokinetic figures appeared in these cells. The background appeared to be formed of lymphocytes. This tumor was considered a lymphoepithelioma.

Cases 3, 4 and 5 were observed at the Stanford University Hospital (Dr. David Wood).

CASE 3.—M. F., a housewife aged 51, was referred to Dr. A. B. Stockton after the removal of an enlarged lymph node in the right upper part of the cervical region. She complained of tinnitus and diminished hearing in her right ear, pain in the right frontal region, right malar eminence and pain with weakness in her right shoulder and arm. She had occasional difficulty in swallowing and attacks in which her right eye seemed rotated outward and downward.

These conditions appeared twenty months previously, following an attack of influenza. At first she noticed the swelling in her neck, which became painful; on its removal the microscopic examination discovered signs of malignancy; sixteen

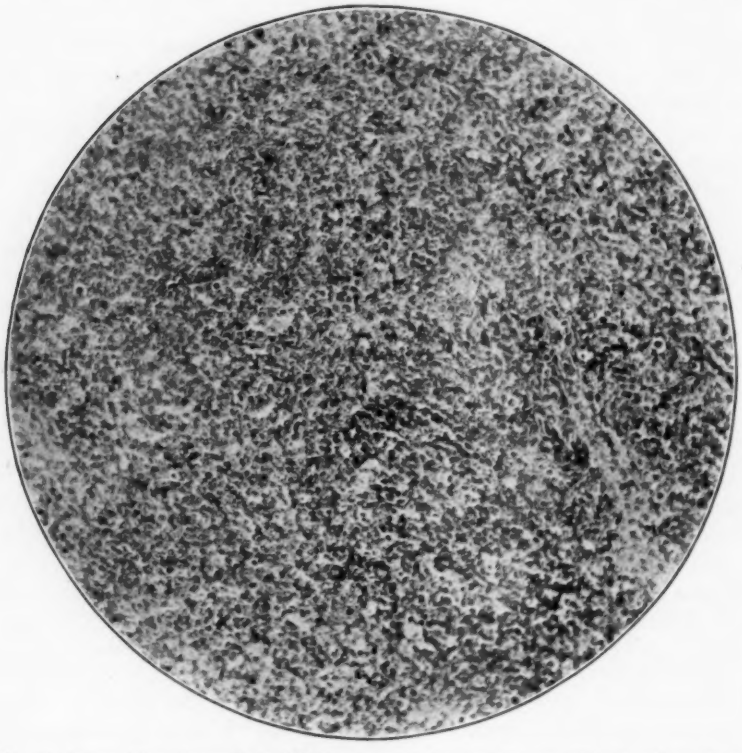

Fig. 1 (case 2).—Lymphoepithelioma of the tonsil, × 75, showing sheets of pale epithelial cells with poorly defined outlines and a moderate admixture of lymphocytes.

months later there was a recurrence, with the present accompanying symptoms. This second node was also removed, and both specimens were sent to Dr. Wood for pathologic examination.

The physical examination showed an emaciated woman with a sallow complexion, inequality of the pupils, diminished hearing in the right ear and a scar in the tonsillar fossa. The oropharynx and the nasopharynx appeared normal; no enlargement could be seen. There were two scars in the right upper part of the cervical region, which were adherent to underlying structures. A chain of lymph nodes could be palpated on the right side of the neck. These nodes were hard and discrete. Neurologic examination and examination of the blood gave negative

results. No evidence of primary growth or metastasis could be found roentgenologically. In all probability the primary neoplasm was located in the eustachian tube.

Histologic Examination.—The slide from the first biopsy revealed a lymph node in which moderate lymphoid hyperplasia was present. In some of the sections the lymph node was invaded by sheets of pale, flat epithelial-like cells, among which were moderate numbers of lymphocytes. Occasional mitotic figures were present. The sheets of cells had apparently infiltrated along the lymph sinuses between the medullary cords.

Fig. 2 (case 4).—Lymphoepithelioma of the nose; × 75. Note the sheets of poorly defined epithelial cells, nonkeratinized but squamous in type. Note also the rich admixture of lymphocytes.

Sections taken at the time of the second biopsy showed lymphoid hyperplasia with prominent lymph follicles and germinal centers. The lymph sinuses contained large numbers of lymphocytes. No tumor cells were seen. In my opinion the tumor seen in the first biopsy was typical of a metastatic lymphoepithelioma of a cervical lymph node. The patient was treated with irradiation with only temporary benefit. She died about one year later.

Case 4.—L. F., a Chinese man aged 27, came to Dr. Russell Fletcher complaining of epistaxis for about eighteen months and of a feeling of "fulness" in the region of the soft palate. Examination showed a slightly emaciated man whose pupils were equal and whose hearing was diminished. On rhinoscopic exami-

nation through the anterior part of the right naris a bleeding mass was noticed in front of the sphenoid, extending to the posterior tip of the inferior turbinate and into the nasopharynx. This was confirmed by roentgenogram. A biopsy was done and the condition was diagnosed by Dr. Wood as endothelioma. This diagnosis was later changed to lymphoepithelioma. The patient then came to Dr. Harvard McNaught with the same complaints. The symptoms were increased. There was by this time a large palpable node at the base of the neck. The Wassermann test was negative. A second specimen of the primary growth was taken and was also sent to Dr. Wood.

Histologic Examination.—Sections showed a tumor which was rather vascular in areas and which was invading the surrounding structures in broad lobulated

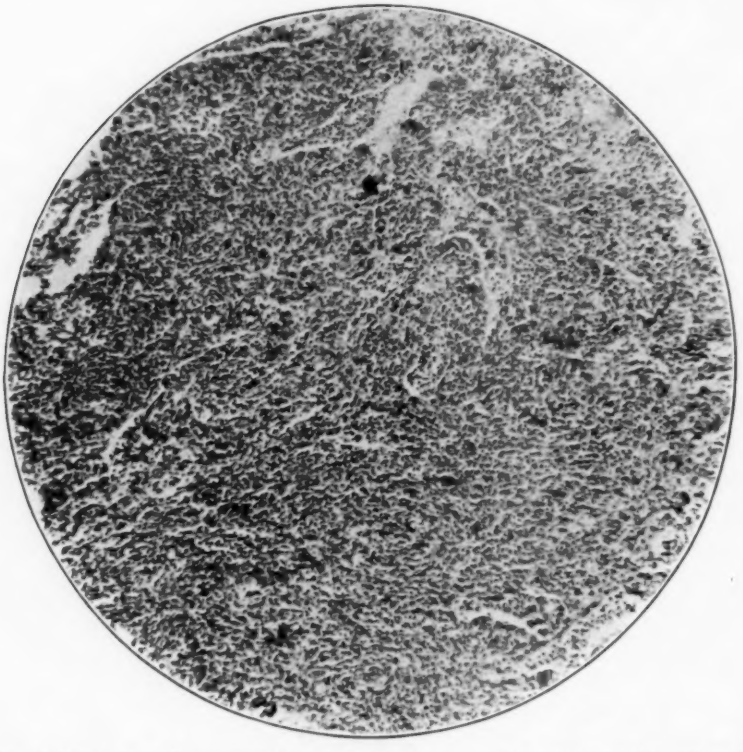

Fig. 3 (case 4).—Recurrent lymphoepithelioma of the nose; × 75. The photomicrograph shows the same histologic characteristics as are shown in figure 2.

strands. The tumor was composed of slightly fusiform pale cells with a moderate amount of finely granular cytoplasm. A moderate number of mitotic figures was present. Some of the lymphatics were dilated and engorged with tumor. A definite peritheliomatous arrangement of the cells was present about the preexisting blood channels. A moderate round cell infiltration was present in some areas. It is difficult to state definitely whether the tumor cells were epithelial or endothelial in origin, and the differential diagnosis rests between angiosarcoma and lymphoepithelioma. It is my opinion that the diagnosis was probably nasopharyngeal lymphoepithelioma.

Dr. R. E. Newell gave protracted roentgen therapy, 300 roentgens daily at 200 kilovolts, the half value layer being 0.8 mm. of copper, over a round field 14 cm. in diameter on each side of the neck alternately for twenty days, or a total of 3,000 roentgens (measured in air) to each side. The reaction to roentgen therapy was extremely severe, and it was nearly a month before healing took place. The gland disappeared and never recurred, but there was still a tumor obstructing the right choana, with a little sanious discharge. A year and a half later the patient received radium to the recurring tumor in the nasopharynx, 100 mg. filtered with 2 mm. of platinum and 6 mm. of gauze for five hours. In December 1937 the outlook was not hopeful.

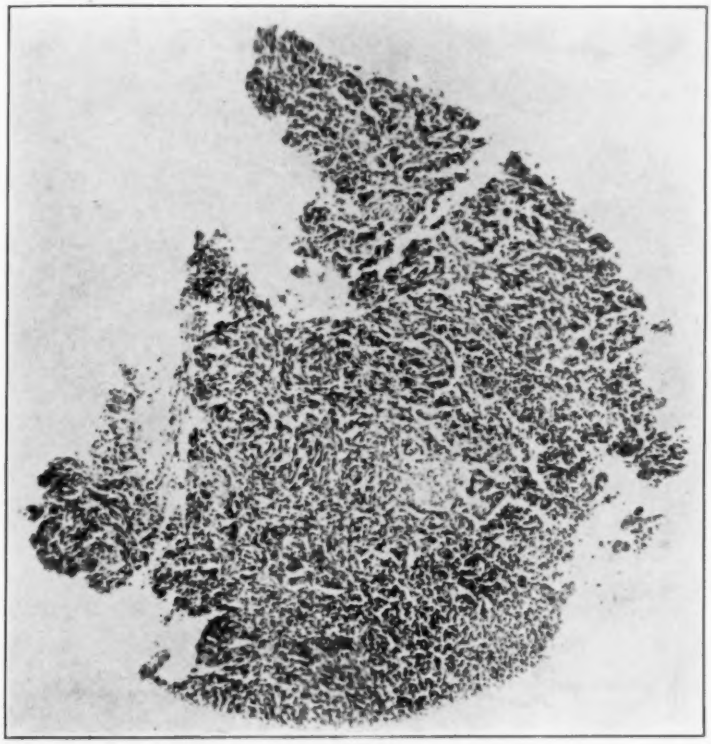

Fig. 4 (case 5).—Primary lymphoepithelioma of the nasopharynx, × 37, discovered eight months after the appearance of metastasis to the cervical lymph nodes.

Case 5.—M. R., a man aged 42, came to the Stanford Clinic complaining of painful swelling on both sides of the neck. The pain, which was intermittent at first, gradually increased in its intensity. The patient had no ear, nose or throat complaints, such as nasal obstruction, postnasal discharge, hawking or secretory catarrh.

Examination disclosed a well nourished man with discrete bilateral swellings from the ear down the posterior border of the sternocleidomastoid muscle. At first nothing abnormal could be found in the nasopharynx or in the throat. Later the patient complained of a sore throat, and the primary growth could be demon-

strated by posterior rhinoscopic examination. By histologic section of the cervical lymph node the condition was diagnosed as metastatic squamous epithelioma. Histologic examination of the primary growth was reported on as follows: "Sections show a number of tiny pieces of tissue from the nasopharynx partially covered by stratified squamous epithelium, which is interrupted in a few places by tumor. The tumor is composed of slender epithelial cells showing a plexiform arrangement. Intermingled between the epithelial cells are moderate numbers of small lymphocytes. A few lymph vessels present are greatly dilated and are engorged with similar tumor. The structure is typical of lymphoepithelioma."

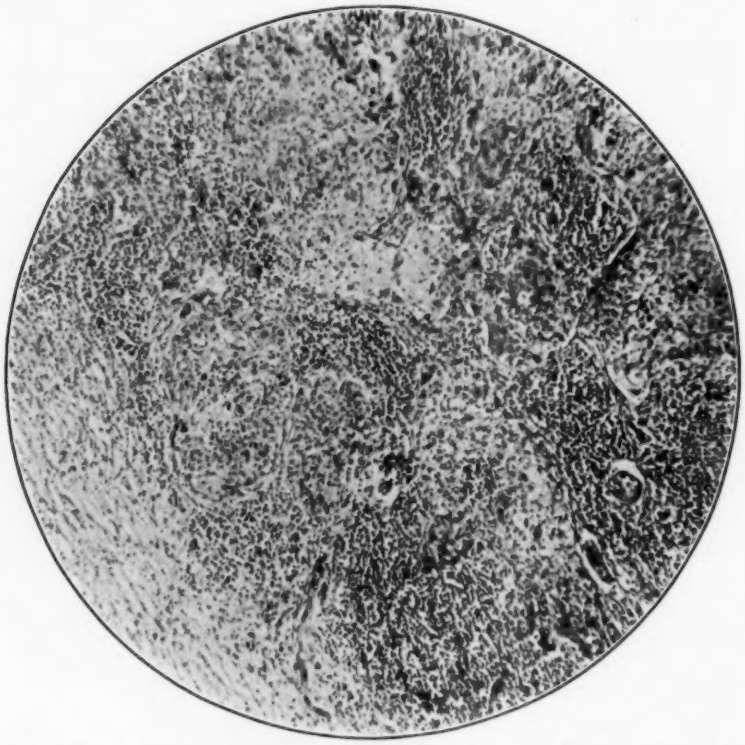

Fig. 5 (case 5).—Metastatic lymphoepithelioma of the cervical lymph nodes, × 75. Note the sheets of epithelial tumor cells which are more definitely squamous in type than those seen in the primary lesion (fig. 4).

Roentgen treatment was started by Dr. Newell on Feb. 9, 1937, and has been intermittently continued up to the present time (Dec. 15, 1937).

The patient received on the right and the left side of the neck alternately, from February 9 to March 17, 200 roentgens daily (measured in air), or a total skin dose of 3,875 roentgens to each side of the neck. He also received, from March 9 to March 25, 200 roentgens to the left axilla, or a skin dose of 3,280 roentgens. The physical factors of the treatment were: voltage, 350 kilovolts; current, 14 milliamperes; filtration, 3 mm. of brass, 1 mm. of aluminum and 1.25 mm. of tin, the half value layer being 2.5 mm. of tin. The output of the tube

was 16 roentgens per minute at a distance of 50 cm. The fields treated were a circle 13 cm. in diameter on each side of the neck and a circle 9.5 cm. in diameter in the left axilla.

The patient rested from March 25 to November 17, approximately eight months. The primary site in the nasopharynx is being exposed daily to 300 roentgens, measured in air, over a circular field 6 cm. in diameter beneath Read's base line.

COMMENT

The functional connection between lymphocytes and epithelium is not yet understood, and therefore two schools of thought as to the pathogenesis of lymphoepithelioma exist today. Schmincke in 1921 described the tumor as an entodermal branchiatic swelling and stated that it develops from remnants of the branchial arches and clefts; that these islets of germinal tissue may remain dormant for years until suddenly, through some unknown factor, cell proliferation takes place. Hoffman in 1932 collected 111 cases reported by 33 observers, and he concluded that the majority of these growths are branchiogenetic and are dependent on congenital anomalies.

Other investigators believe that the tumor arises from the epithelial organ itself and not from any congenital rest.

Massione and Bang and Juul reported that the primary tumor is small and may be overlooked. The growth is slow, and metastases to the lymph nodes are frequent, often dominating the entire picture. The metastases are not necessarily confined to the cervical region; the axillary, mediastinal, peritoneal and inguinal nodes may be involved as well as the bone marrow and nerve tissue. In the 2 cases reported from the Rudolph Hospital local enlargement of the primary site occurred before metastasis to the nodes. This is true of several cases reported by other investigators. Probably the early metastasis is due to the fact that the tumor breaks into a large vessel or lymph channel. Laas and Wu reported that the typical lymphoepithelioma of the thymus is benign.

The tumor occurs with equal frequency in both sexes. The youngest patient in the cases reported was 14 and the oldest 71. The tumor, particularly in the nasopharynx or in the tonsil, may ulcerate early, according to the rapidity of its growth. Generally the tumor is hard and increases in size only slowly.

On histologic examination the tissue is found in some cases to consist of syncytial sheets of pale polyhedral epithelial-like cells embedded in a lymphoid stroma, itself lying in a fine fibrillary reticulum; in other cases much difficulty is encountered before any epithelial-like cells can be found, and then the growth is often regarded as a sarcoma, as an endothelioma or, if the lymphocytes predominate, as a lymphosarcoma. Reticulosarcomas, which are rich in cell fibrils, can be differentiated from lymphoepitheliomas, which have only silver and collagenous fibrils

located in the vicinity of the vessels. The fibrils of the reticulosarcoma can be demonstrated by Van Gieson's or Mallory's stain. Von Zalka expressed the opinion that Foot's impregnation method can stain them more clearly.

The histologic differentiation of these tumors is not easy and requires a diagnostician of vast experience in this type of work. In the cases reported the tumors were submitted to more than one authority.

After irradiation the tumor cells are replaced by granulation tissue associated with a moderate number of lymphocytes. When the granulation tissue disappears its place is taken by scar tissue containing histiogenic mast cells.

Lymphoepitheliomas appear to be extremely radiosensitive. The earlier the diagnosis is made, especially before metastases occur, the more favorable will be the outcome. On the other hand, if the secondary growth is pronounced or if it is located in the bone marrow or nerve tissue, the condition will probably terminate fatally no matter how much irradiation is given. Bang said that a dose of from 1,000 to 2,000 roentgens to the primary tumor of the tonsil is required. Zanni used 12 needles, each with 3.77 mg. of radium, inserted in the primary tumor for seven days, while a moulage with 30 mg. of radium was applied to the neck for nine days. Joly, with a case in which the primary tumor was located in the nasopharynx, used 2,000 roentgens in three weeks. The patient was well after seven years. Massione, in 2 of his cases, applied a moulage to each of four foci, with 10 mg. of radium element filtered by 2 mm. of platinum, in 1 case for seventeen days and in the other for twenty days.

The otolaryngologist should rely on the advice of a good roentgenologist as to the amount of irradiation necessary. One cannot follow a rule of thumb, because every case is different. If the growth is accessible and the infiltration is not too great, surgical treatment can be combined with irradiation.

SUMMARY

Lymphoepithelioma is relatively rare.

The metastases are frequently pronounced; the site of the primary growth is often overlooked and is extremely difficult to find.

The histologic differentiation is difficult.

The tumor is radio-sensitive.

Five cases are reported.

A bibliography of the entire literature is presented.

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450 Sutter Street.

INFLUENZA WITH SIMULTANEOUS BILATERAL SPONTANEOUS PNEUMOTHORAX AND SUBCUTANEOUS EMPHYSEMA

REPORT OF A CASE, WITH COMMENT ON THE MECHANISM OF PRODUCTION

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AND
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In his extensive review of the literature, McMahon [1] found reports of cases of bilateral spontaneous pneumothorax in patients suffering from pulmonary tuberculosis (19), miliary tuberculosis (1), pulmonary carcinoma (4), emphysema (4), asthma (1), congenital deformity of the chest with aplasia of the lungs (1) and trauma (10). Five instances have been reported of occurrence in apparently healthy persons: 3 in Kjaergaard's [2] review of the literature and 1 each by McMahon [1] and Markson and Johnson.[3] A review of the literature of the past eighteen years disclosed three reports,[4] describing 7 cases of spontaneous pneumothorax—unilateral in each instance—complicating influenzal pneumonia and occurring from one to three weeks after the onset of the disease.

The case presented in this paper is apparently the first to be reported in which simultaneous bilateral spontaneous pneumothorax complicated influenza.[4a] Although the roentgenogram showing the existence of bilateral pneumothorax was not obtained before trache-

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From the Willard Parker Hospital, Department of Hospitals, New York.

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2. Kjaergaard, H.: Spontaneous Pneumothorax in the Apparently Healthy, Acta med. Scandinav., 1932, supp. 43, p. 1.

3. Markson, E. E., and Johnson, W.: Simultaneous, Bilateral Spontaneous Pneumothorax: Report of a Case, with a Brief Discussion of the Literature, J. A. M. A. **102**:826 (March 17) 1934.

4. Meyer, O.: Two Cases of Spontaneous Pneumothorax in Children Suffering from Influenzal Lung Affections, Monatschr. f. Kinderh. **14**:207, 1916. Weber, F. P.: A Case of Spontaneous Pneumothorax in the Course of Influenzal Pneumonia, Brit. M. J. **1**:8 (Jan. 4) 1919. Wollenweber, M.: Spontaneous Pneumothorax Occurring During Influenza in Infants and Small Children: Report of Four Cases, Arch. f. Kinderh. **90**:222 (May 24) 1930.

4a. These observations antedate the work on influenza virus.

otomy, nevertheless thin, translucent pleura bulging into the wound unaccompanied by lung showed that a pneumothorax was already present. The case to be presented is of interest not only because it is the first of its kind to be reported but because of the concomitant extensive subcutaneous emphysema, the unusual difficulties arising during tracheotomy, the rapid response of the simultaneous collapse to controlled withdrawal of air and the superimposed overwhelming infections with Bacillus influenzae, which caused septicemia, meningitis and endocarditis, and with Streptococcus haemolyticus and Corynebacterium diphtheriae.

REPORT OF CASE

A 2 year old white boy was brought to the Willard Parker Hospital at 5 a. m. on Nov. 2, 1934. He had apparently been well until eight hours before admission, when he awoke, began to cough and had slight difficulty in breathing. A diagnosis of a "cold in the throat" was made by his physician, and he was treated palliatively. The dyspnea increased to such a degree in the next few hours that the child was taken to the nearest hospital. There a diagnosis of croup was made and an ambulance of Willard Parker Hospital summoned. The past history was irrelevant. Three injections of diphtheria toxoid had been given three months previously.

On admission the child appeared moribund. He was ashen pale, exhausted and restless, with moderate suprasternal retractions on inspiration and gasping, stertorous breathing. Because of his critical condition the chest was examined hurriedly; breath sounds, though obscured by the transmitted laryngeal stridor, were diminished throughout. A direct examination with the laryngoscope showed the epiglottis, aryepiglottic folds and arytenoid cartilages to be markedly congested and so edematous that the glottis could barely be seen. There was no membrane or exudate. To overcome the obstructing supraglottic swelling an immediate tracheotomy was decided on. A metal tube (Willard Parker type), ordinarily used for laryngeal suction, was inserted through the laryngoscope into the trachea to provide an ample airway during the operation. The relief given by the tube, although considerable, was not so complete as is usual in cases of supraglottic edema. Inspiration became much easier, but expiration was still difficult.

With the aid of local anesthesia (1 per cent procaine hydrochloride), the usual tracheotomy incision (1½ inches [3.8 cm.] long) was made below the cricoid cartilage. The pretracheal fascia was readily exposed and no bleeding encountered. At this point the operator (A. H. N.) witnessed a phenomenon which he had not encountered before, although he had performed more than 20 tracheotomies for the relief of acute laryngeal obstruction. There was a ballooning of pleura into the tracheotomy wound with each expiratory effort. This thin, translucent pleural bubble, the size of a large grape, arose in the inferior angle of the wound, on the left side, and ballooned over the trachea, so that tracheotomy was impossible without puncturing the pleura. With considerable difficulty, the intruding pleura was carefully retracted, and then the second, third and fourth tracheal rings were incised from below upward, and a two year tracheotomy tube was inserted. The metal tube in the trachea was then withdrawn. The skin was not sutured. It should be mentioned that the hissing sound which is heard when the pleura is incised was absent in this case.

The ballooning of the cervical pleura was not explained until later, when the diagnosis of pneumothorax was made. What had occurred was that with each expiration intrapleural pressure increased and the air in the distended pleural sac was naturally displaced to the point of least resistance, in this case the opening in the neck.

After tracheotomy the child was greatly, but not completely, relieved; expiration continued to be more difficult than inspiration. At this time the temperature was 103 F., the pulse rate 140 and the respiratory rate 54. Because of the transmitted tracheal stridor, breath sounds were difficult to evaluate. About fifteen minutes after tracheotomy, subcutaneous emphysema of the neck was noted. During the next hour and a half the emphysema spread down to the chest and the child became progressively more dyspneic. The blast of air from the tracheotomy tube diminished in force and volume. To eliminate the possibility of tracheal obstruction, suction was applied by means of a rubber catheter. This gave no relief, and the child suddenly stopped breathing and became intensely cyanotic. Epinephrine (5 minims [0.3 cc.]) had just been given subcutaneously. On ausculation, heart sounds were not heard. Artificial respiration and cardiac massage,

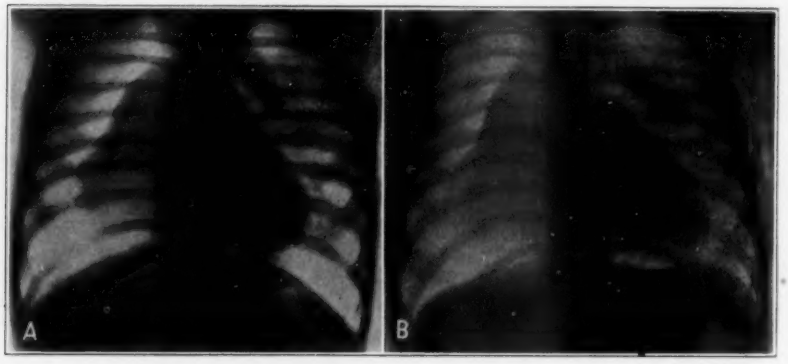

Fig. 1.—*A*, two and a half hours after tracheotomy: bilateral pneumothorax and subcutaneous emphysema on the left side. *B*, forty minutes after the first evacuation of air: slight reexpansion of the lungs and increased subcutaneous emphysema.

with the right hand pushing vigorously against the diaphragm and the left hand pressing down over the precordium, were immediately begun. After approximately thirty seconds, the heart was heard beating faintly and slowly. Gradually, the child began to breathe and the heart sounds became rapid and pounding. Oxygen was given through a funnel placed over the tracheotomy tube. Examination of the chest showed a slight increase in resonance and marked diminution of the breath sounds on both sides. The heart was in its normal position. A tentative diagnosis of bilateral pneumothorax was made, and an hour later, when a roentgenogram could be taken with the portable apparatus, the diagnosis was confirmed (fig. 1 *A*). On the right side there was a large pneumothorax, with about 60 per cent collapse of the lung. On the left side there was marked subcutaneous emphysema extending down from the neck and separating the skin about ¾ inch (1.9 cm.) from the lateral chest and abdominal walls. This emphysema obscured the view of the left side of the thoracic cavity, but as far as could be seen there were almost complete collapse of the upper lobe and slight collapse of the lower.

After roentgenographic confirmation of the diagnosis, the ordinary pneumothorax apparatus was used to measure intrapleural pressure and to withdraw the air. The pressure in the right pleural space varied between +1 and —1 cm. of water. After 600 cc. of air was removed, the pressure fell to between —6 and —8 cm. On the left side also the pressure was found to be between +1 and —1 cm., and here too 600 cc. of air was removed, until the pressure was between —8 and —10 cm. During the procedure the child's condition and color improved considerably, and he fell asleep, breathing quietly. Breath sounds

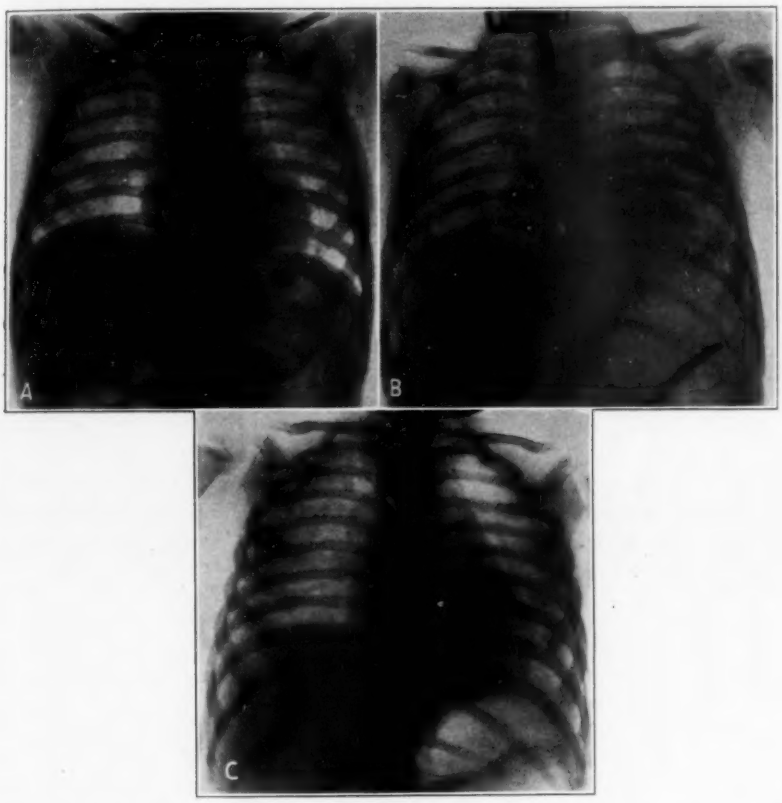

Fig. 2.—*A*, eighteen hours after the second evacuation of air: complete reexpansion of the lungs and bronchopneumonic infiltration of the right. *B*, one day later: increased pneumonic consolidation and disappearance of subcutaneous emphysema. *C*, two days later: bilateral fibrinous pleurisy and widespread bronchopneumonia.

were transmitted throughout the chest. Another roentgenogram was taken forty minutes later (fig. 1*B*). This showed slight expansion on both sides and slight displacement of the mediastinum to the left.

In the next two hours the child became progressively worse, showing the same signs and symptoms as prior to the evacuation of the pleurae. The right pleural cavity was again punctured, and the pressure was found to vary between

—2 and + 4 cm. After 550 cc. of air had been removed the pressure fell to between —14 and —16 cm. On the left side the pressure at the outset was between —4 and —6 cm. It fell to between —16 and —18 cm. after 150 cc. of air had been withdrawn. After this the child became alert and began to breathe easily and slowly, and breath sounds were heard well throughout the chest. By this time the subcutaneous emphysema had extended from the mandible down to the scrotum. Another roentgenogram (fig. 2 *A*), taken eighteen hours later, showed the lungs to be completely expanded, with bronchopneumonic infiltration in the upper and the lower lobe of the right lung. There was a small strip of air along the cardiac border, interpreted as residual mediastinal emphysema. The subcutaneous emphysema had decreased greatly. A roentgenogram (fig. 2 *B*) on the fourth day of illness showed increased consolidation of the right lung and diminution of the subcutaneous and mediastinal emphysema.

The tracheotomy tube was changed daily and a moderate amount of mucopus removed each time. The child's condition during this period continued to be grave; the temperature ranged between 101 and 104 F., the pulse rate between 130 and 160 and the respiratory rate between 34 and 80. He was given oxygen continuously at the rate of 4 liters per minute by means of a funnel placed directly over the tracheotomy tube.

The blood count taken on admission was: erythrocytes, 3,640,000; hemoglobin content (Sahli), 70 per cent, and leukocytes, 2,500, with 56 per cent polymorphonuclears, 39 per cent lymphocytes and 5 per cent large monocytes. There was slight anisocytosis and achromia. Two days later there were 3,500 leukocytes with 33 per cent polymorphonuclears, 52 per cent lymphocytes, 14 per cent large monocytes and 1 per cent basophils. There was marked achromia. Because of the suppression of white blood cells, liver extract was administered. Within twelve hours four vials of liver extract (Lederle), representing 400 Gm. of liver, were given by intramuscular injection. The next day there were 11,450 leukocytes, with 85 per cent polymorphonuclears, 8 per cent lymphocytes, 3 per cent large monocytes, 4 per cent metamyelocytes and many young polymorphonuclear leukocytes. The child was then given one more intramuscular injection of liver extract, representing 200 Gm. of liver. A blood count the next day showed: erythrocytes, 3,830,000; hemoglobin content (Sahli), 75 per cent, and leukocytes, 12,400, with 89 per cent polymorphonuclears, 8 per cent lymphocytes and 3 per cent large monocytes. Two days later the count was practically the same.

On November 7, the sixth day of illness, the breathing became more rapid, and the blast of air from the tracheotomy tube was diminished in force and volume. Physical examination of the chest was suggestive of bilateral pleurisy. A roentgenogram (fig. 2 *C*) revealed bilateral fibrinous pleurisy and pneumonic consolidation of the lower lobe of the left lung and the lower three fourths of the right lung. The left pleural cavity was tapped, and about 6 cc. of thin yellowish fluid was obtained. There was marked gaseous distention of the intestine, which responded to treatment. A small transfusion of citrated blood was given. After tracheotomy, several drops of warmed 5 per cent solution of sodium bicarbonate had been instilled into the trachea every half hour. This seemed to lessen the drying of the mucopus. However, the trachea and bronchi became clogged repeatedly with this gummy mucopus, and frequent removal by suction with a soft rubber catheter or metal suction tubes was required. On the last day of illness, a shred of thin membrane was obtained after tracheobronchial suction. On November 12 the eleventh day of illness, the child's condition became distinctly worse. He was cyanotic and restless; the heart sounds were weak and irregular, and the flow of air from the tube was poor. He suddenly stopped breathing and could not be revived.

Although there had been no suspicious meningeal signs, a spinal tap, done immediately post mortem, yielded 10 cc. of opalescent fluid. This contained 1,195 cells per cubic millimeter, with 90 per cent polymorphonuclears and a large number of gram-negative bacilli and of extracellular coccobacilli, which on culture proved to be B. influenzae. The dextrose content was normal, and the albumin and the globulin were slightly increased. A culture of blood taken two days after admission, the third day of illness, showed a slowly growing gram-negative bacillus, which proved to be B. influenzae. Culture of material

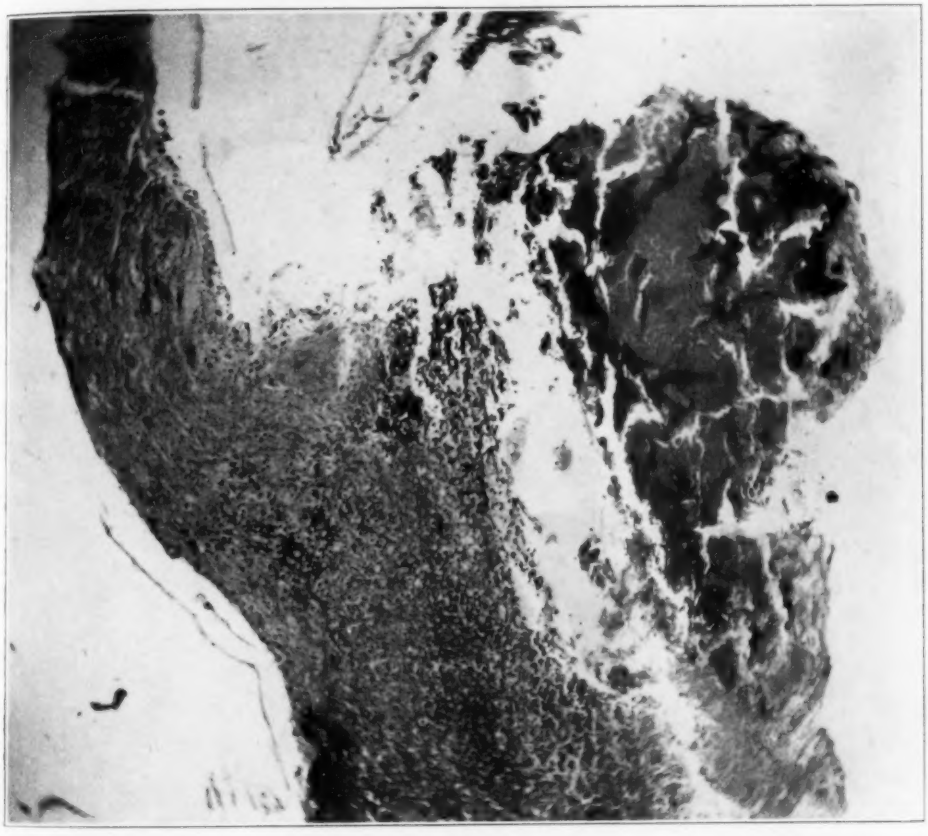

Fig. 3.—Section through the tricuspid valve showing vegetative endocarditis with overlying thrombus (stained with phloxin-methylene blue—Paul's modification of Mallory's eosin-methylene blue— × 150).

from the larynx and trachea showed Streptococcus viridans and B. influenzae. Culture of the fluid obtained from the left pleural cavity showed B. influenzae. The Wassermann test was negative. The Schick test was doubtful after forty-eight hours and negative after seventy-two and after ninety-six hours. The urine showed traces of albumin and acetone on several occasions.

Following are the essential postmortem observations, as reported by the pathologist, Dr. Lawrence W. Smith:

Heart.—On one cusp of the tricuspid valve was a small brownish yellow fibrinous vegetation, about 3 mm. in diameter, overlying which was a tiny gray thrombus. Sections through the tricuspid valve confirmed the gross diagnosis of definite bacterial endocarditis (fig. 3). Characteristic vegetations were noted microscopically, made up of fibrin, red cells and leukocytes. Both coccoid and

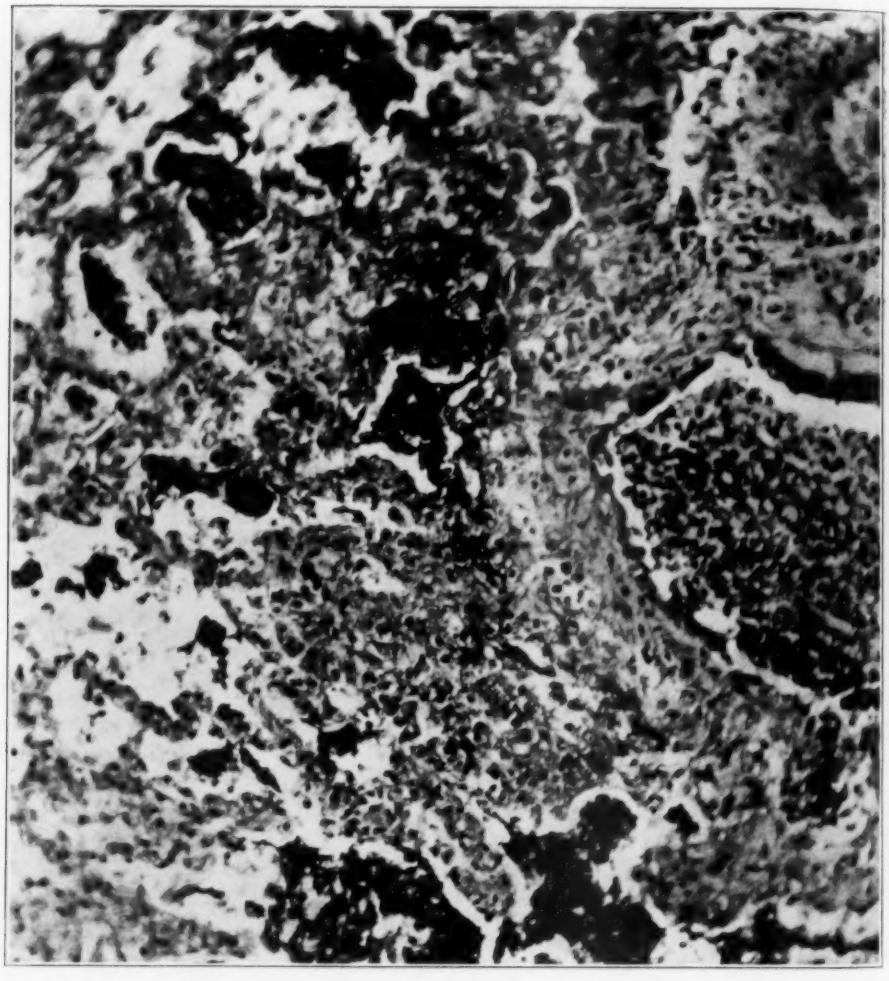

Fig. 4.—Section of the lung showing acute purulent bronchitis and bronchopneumonia and characteristic interstitial pneumonitis with peribronchial monocytic infiltration and lymphoid hyperplasia (phloxin-methylene blue stain—× 300).

short bacillary organisms were observed in the meshes of this exudate. Sections through the musculature showed a moderate amount of interstitial edema, with capillary dilatation. There was considerable edema of the epicardial tissues, with a few foci of monocytic cellular infiltration, chiefly around small blood vessels.

Pleural Cavities.—The pleural cavities showed extensive pleuritis, with a number of small loculated pockets containing only a few cubic centimeters of turbid fluid. Both cavities were practically obliterated by a heavy layer of yellow, buttery fibrin, which was plastered to both the parietal and the visceral pleura and was more than 1 cm. thick in places. The surface of the pleura was largely denuded and showed acute inflammatory changes, with beginning fibrosis.

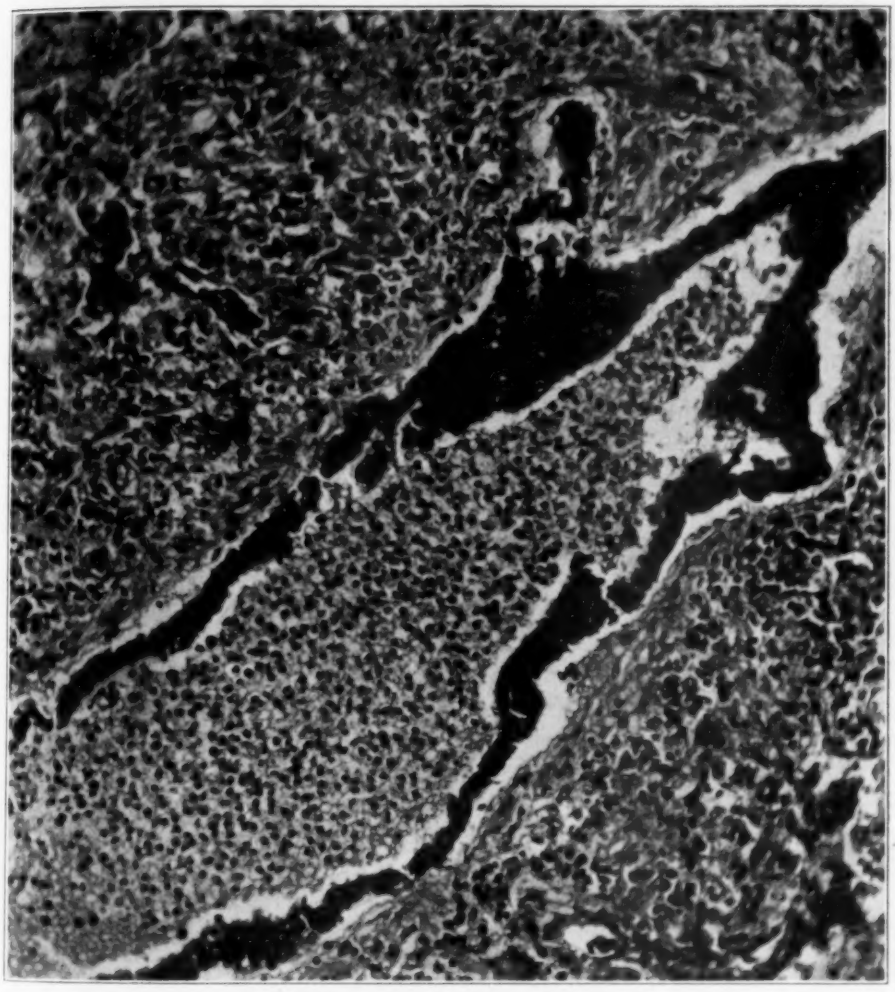

Fig. 5.—Section of the left lung showing fibrin precipitation in addition to the pathologic condition seen in figure 4 (phloxin-methylene blue stain—× 300).

Lungs.—Both lungs showed essentially the same picture, slightly more marked in the right. The parenchyma was a mottled gray and meaty-looking pink, evidently due to alternating areas of atelectasis and pneumonia. Sections of the lungs, from various portions all sank in water. The bronchi were filled with a creamy yellow exudate, and the mucosa was markedly injected. Microscopic

examination of the sections showed a varying picture, with some areas of atelectasis and a few corresponding emphysematous alveoli. For the most part, the picture was one of a descending infection of the respiratory tree, with a marked fibrinopurulent exudate filling the bronchi and bronchioles. In places the fibrin was precipitated in such large amounts on the surface as to suggest a diphtheritic membrane (fig. 4). Most of the picture was one of diffuse exudative fibrinopurulent bronchopneumonia, almost confluent in type. However, masked by this presumably streptococcic inflammation, there could be seen the more characteristic interstitial pneumonitis, which is frequently associated with an influenzal infection. This was best noted in the peribronchial structures, where considerable monocytic infiltration and lymphoid hyperplasia were present and extended from these areas into the alveolar walls of the regional parenchyma of the lung (fig. 5).

Other Organs.—Fibrinopurulent mediastinitis, tracheitis, marked toxic changes in the liver, spleen and lymph nodes and lymphoid hyperplasia of the ileum and cecum were observed. At the site of the Schick test there was slight pigmentation. The brain was not examined. Postmortem cultures of material from the trachea, anterior mediastinum, left lung and left and right pleura showed B. influenzae and Str. haemolyticus. In addition, toxin-producing C. diphtheriae was isolated from the left lung.

COMMENT

An interesting feature is the occurrence of both spontaneous pneumothorax and subcutaneous emphysema. The pneumothorax developed first. The subcutaneous emphysema appeared shortly after the tracheotomy. Although subcutaneous emphysema is often seen after tracheotomy, because of the trapping of air in the tissues laid open during the operation, it is rarely so extensive as that which occurred in this case.

The occurrence of the pneumothorax and of the subcutaneous emphysema can be similarly explained. The obstruction of the bronchioles by exudate and the extensive supraglottic edema combined to produce violent inspiratory efforts. The dilatation of the bronchioles caused by the strenuous inspiratory efforts and the concomitant diminution of their contractile, expulsive power caused by the influenzal infection resulted in overdistention and coalescence of the functioning pulmonary alveoli. Thus, when there was incomplete bronchiolar obstruction great inspiratory effort could draw air in, but, the expiratory force being insufficient to expel it, alveolar distention resulted. As a result of the overdistention, certain of the emphysematous lobules burst. If they were subpleural, air passed into the pleura. If the visceral pleura or a piece of fibrin or clot forms a flapper valve over the rent in the lung, or if the opening in the lung is compressed or closed during expiration, the escape of the air is obstructed and tension pneumothorax, such as occurred in this case, is produced. If the tear is not into the pleura, the air is forced into the pulmonary interstitial tissue and travels along the loose tissues surrounding the blood and lymph vessels and bronchi to the root of the lung, where it either ascends

between the mediastinal fascial planes and appears in the neck, spreading down from this point or, more rarely, descends into the retroperitoneal space and perirenal tissues. If there are adhesions between the visceral and the parietal pleura, air may appear in the thoracic wall without traveling down from the neck.

One of us (J. G. M. B.[5]) has called attention to this mechanism in the production of subcutaneous and tissue emphysema. These observations were corroborated by Torrey and Grosh,[6] working in an army camp. They observed: "Many of these men developed their bronchitic emphysema during the first or second day of influenza. . . . The rapid massive involvement (of the lungs) was accompanied or even preceded by the generalized pulmonary emphysema. . . ." There were ". . . intense dyspnea . . . and erection of the chest fixed in a state of hyperinspiration, with only tidal air movement."

There was

> Marked stasis of all the veins entering the chest. . . . Cyanosis became more profound. . . . When in apparent respiratory extremis, frequently a patient would begin to complain of pains, substernal and in the jugular fossae, and crepitation would be noted in the subcutaneous tissue at the root of the neck, and immediate marked subjective relief was apparent, rapidly followed by a noticeable improvement in the respiratory excursion of the chest, and the most striking decrease in cyanosis and jugular distention. . . . Cutaneous emphysema soon became diffuse, not infrequently spreading down the trunk to the pubes. . . . As the intrathoracic pressure was thus relieved these apparently moribund patients often went on to recovery. . . . A number of the patients dying in this stage of early emphysema came to autopsy. The cause of death was evidently the mechanical obstruction of the return flow of the venous blood . . . by the thoracic fixation interfering with the mass movement of the blood.

Examination of the thoracic contents often showed ". . . large emphysematous bullae of the lung and particularly of the mediastinal alveolar tissue. . . . The emphysema was such that the lungs could not be collapsed by pressure."

Lynah,[7] discussing influenzal croup during the epidemic of 1918, accepted Bullowa's explanation and described a "bronchopulmonary or asthmatic type" in which ". . . the onset may be extremely violent or the condition may be ushered in with all the premonitory symptoms of laryngotracheobronchitis. The child may be stricken with a fulminating influenzal asthma even while asleep." The asthmatic attack

> . . . is probably due to the enormous engorgement of the lung producing inelasticity. The markedly engorged inelastic lung is not expanded on inspira-

5. Bullowa, J. G. M.: Tissue Emphysema in Influenza, M. Rec. **95**:346 (Feb. 22) 1919.

6. Torrey, R. G., and Grosh, L. C.: Acute Pulmonary Emphysema Observed During the Epidemic of Influenzal Pneumonia at Camp Hancock, Georgia, Am. J. M. Sc. **157**:170 (Feb.) 1919.

7. Lynah, H. L.: Influenzal Croup, Am. J. Dis. Child. **18**:238 (Oct.) 1919.

tion so that the functioning elastic vesicles are overdistended, producing acute pulmonary emphysema. If the condition becomes extreme, interstitial or tissue emphysema may result. In this type of case the absence of cough may be noteworthy, even on introduction of the bronchoscope. . . . Their difficulty is expiratory.

SUMMARY AND CONCLUSIONS

A case of severe influenza complicated by simultaneous bilateral spontaneous pneumothorax and extensive subcutaneous emphysema is presented, and the mechanism of these complications is discussed. The diagnosis of clinical influenza was based on the sudden and severe onset, with laryngeal and pulmonary symptoms; the marked leukopenia, with relative lymphocytosis, and the postmortem observations on the lung. Aside from the fact that it appears to be the first case of its kind to be reported, the case presented several unusual features:

1. The pneumothorax gave rise to an unusual phenomenon, causing considerable difficulty during tracheotomy.

2. Shortly after tracheotomy the flow of air decreased progressively; the child suddenly stopped breathing, and heart sounds were not heard. Vigorous cardiac massage and artificial respiration revived the patient.

3. The bilateral collapse responded rapidly to controlled evacuation of the pleural cavities, and there was no recurrence during the next ten days.

4. The fatal outcome was apparently due to the superimposed overwhelming infection with B. influenzae, which resulted in septicemia, endocarditis with vegetations on the tricuspid valve, meningitis and pneumonia with pleurisy. In addition, there was infection with Str. haemolyticus and, evidently toward the end, with C. diphtheriae.

5. The rapid change from marked leukopenia with relative lymphocytosis to leukocytosis involving polymorphonuclear cells after the injections of liver extract is interesting. The change may have been coincidental, due to the spread of pneumonia and the complicating infection of the meninges with B. influenzae, which, according to Neal and her associates,[8] causes a high increase in polymorphonuclear leukocytes. However, pneumonia was already present, and B. influenzae was recovered from the blood in pure culture on the day that there was such marked leukopenia with relative lymphocytosis. The increase in leukocytes may conceivably have been due to the liver extract.

152 East Ninety-Fourth Street.

62 West Eighty-Seventh Street.

8. Neal, J. B.; Jackson, H. W., and Applebaum, E.: Meningitis Due to the Influenza Bacillus of Pfeiffer (Hemophilus Influenzae), J. A. M. A. **102**:513 (Feb. 17) 1934.

CONGENITAL DERMOID CYST AND FISTULA OF THE DORSUM OF THE NOSE

REPORT OF A CASE

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The present case was deemed sufficiently rare and interesting to warrant reporting.

David F., aged 4 years, was admitted to the County Hospital April 17, 1937. The history showed that the boy was born with a pinpoint sinus on the dorsum of the nose, from which blood, yellow material, hair and watery fluid were occasionally discharged.

Two years previously the child had bumped his forehead. A swelling and abscess developed and was incised. The incision had failed to heal completely, so that from time to time there were redness, swelling and finally discharge. When the lesion on the forehead was active, that on the nasal dorsum usually remained inactive, and later the reverse would occur. The boy was admitted to the surgical service because it was believed he had osteomyelitis of the frontal bone. However, roentgen examination did not support this diagnosis, and physicians of the neurosurgical service were consulted. The tentative diagnosis made by the neurosurgeon was "frontal cerebrospinal fluid fistula and also cerebrospinal rhinorrhea." Observation for several days did not confirm this diagnosis, and physicians of the nose and throat service were asked to see the boy. Examination of the nose and the definite history of a fistula since birth resulted in the diagnosis of congenital fistula and cyst of the nasal dorsum. The lesion of the forehead was believed to be an upward extension from the cyst, which had been activated when the boy bumped his forehead. This would account for the failure of the operative wound to heal completely (fig. 1). An attempt to outline the passage with iodized poppyseed oil was unsuccessful, as the material could not be forced into the fistulous opening. In June the boy fell. A septal abscess developed, which healed after incision and drainage.

In August it was decided to attempt removal of the fistulous tract of the forehead. With the child under ether anesthesia a definite sac was removed and its lower constricted part followed to the root of the nose, where its further extension was lost. Primary healing occurred, and the wound remained healed until October, when a fluctuating swelling again developed. After incision this promptly healed. It has remained healed to date (Feb. 25, 1938).

On Nov. 22, 1937, a second operation was performed. A cystic cavity was found at the site of the fistula on the nasal dorsum. An attempt was made to remove it completely, and it was seen that a large part of the cyst was beneath the level of the nasal bones, the two portions being connected through a round opening between the lower part of the nasal bones. The outer portion of the sac

Read at a meeting of the Chicago Otolaryngological Society, Feb. 7, 1938.

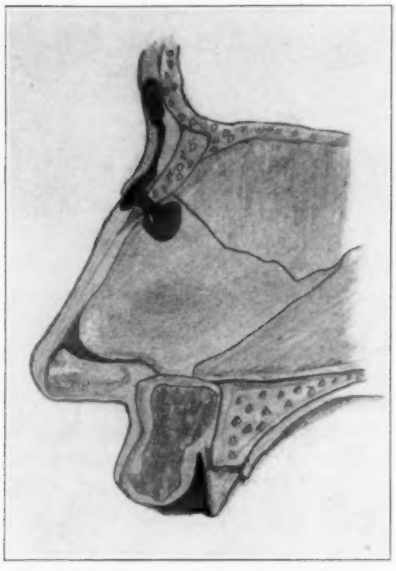

Fig. 1.—Midline section through the nose. The dermoid cyst can be seen extending downward between the nasal bones and opening outward as a fistula on the nasal dorsum. An extension passes upward to the frontal region, ending in a sac.

Fig. 2.—David F., aged 5 years. The photograph shows the operative areas two months after the second, or nasal, operation.

was removed, and an extension upward to the root of the nose was followed as far as possible. Some secretion and a large number of black hairs were encountered. The deep portion of the cyst did not communicate with either nasal passage, although the intervening soft tissue was not especially thick. On account of the danger of establishing an opening into the nose, this portion of the sac was not excised but was thoroughly curetted and treated with acetone-trinitrophenol, phenol and alcohol. The incision was closed, and after a day or two of drainage the wound healed satisfactorily. At present the site of the former fistula appears normal; there is little scarring. The scar on the forehead is more prominent, apparently owing to the number of times the tissues have been infected (fig. 2).

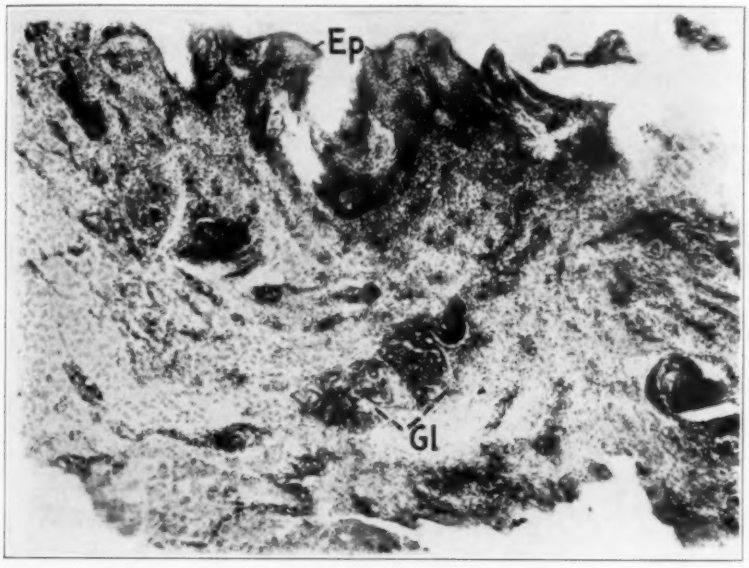

Fig. 3.—Wall of cyst, showing epithelium (*Ep*) lining the cavity. Beneath the epithelium are the sweat glands (*Gl*).

The wall of the cyst was examined microscopically and a tract lined by stratified squamous epithelium revealed. There were hair follicles and sweat glands in the dermis. The diagnosis was dermoid cyst of the nose (figs. 3 and 4).

A review of the literature reveals only 3 American reports of dermoid cyst of the nose. One of these was by Luongo, who reviewed the reported cases up to 1933. There are approximately twenty-six articles in the literature on this subject. Luongo said that dermoid cysts about the nose have been found (1) between the lower margin of the nasal bones and the tip, (2) on the nasal bridge, (3) near the tip and (4) at the inner angle of the orbit and the nasofacial sulcus. The dermoid cysts which are located in the area of the embryonal fissures are formed by the sequestration of portions of the surface epithelium

during the process of closure of the fissures. Luongo stated that it is believed that the dermoids in the midline are formed as follows: In the early embryo the frontal plate, which forms the nose, consists of a lamina of hyaline cartilage covered externally with skin and internally with mucosa. After the third month of embryonal life bony tissue extends in between the skin and cartilage. This bony tissue will form the nasal bones. The cartilage becomes absorbed during this process of ossification. During the gradual separation of the skin from the cartilage of the frontonasal plate by the intrusion of the nasal bones, small portions of the skin or epithelium become sequestrated and develop into a dermoid cyst. In a recent article C. E. Benjamins stated that

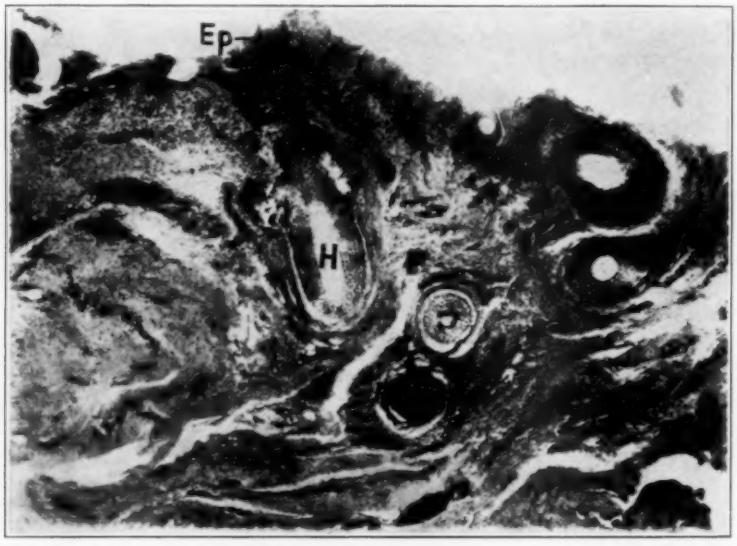

Fig. 4.—Wall of cyst, showing epithelium (*Ep*) lining the cavity. Beneath the epithelium a number of hairs (*H*) are seen.

the structure results from faulty development in the region of the sulcus supranasalis in the embryo. Thus ectodermal rests become buried in the tissues at the root of the nose. He noted that the cyst does not connect with the nose or the dura, although in 1 of his cases the wall of the cyst was adjacent to the dura in the frontal region. Benjamin advised operation as a cure. He has not found the subsequent scar particularly noticeable.

A consideration of the present case and of the literature indicates the rarity of dermoid cysts of the nasal dorsum and shows the danger of improper diagnosis.

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BILATERAL ACOUSTIC NEUROFIBROMAS

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Bilateral acoustic neurofibromas, although not rare, are uncommon as compared with the unilateral lesions of this type and respond more satisfactorily to palliative surgical procedures. Since 1910, 152 proved cases of tumor of the eighth cranial nerve have been observed at the Mayo Clinic. The tumor was bilateral in only 2 of these cases; in both it was associated with generalized neurofibromatosis without a hereditary background.

Bilateral tumor of the cerebellopontile angle was recorded first by Wishart [1] in 1822 and by Knoblauch [2] in 1843. Later it was described in more detail by Henneberg and Koch,[3] in 1902. In 1912 Henschen [4] described 136 cases of unilateral and 19 cases of bilateral tumor of the cerebellopontile angle. In 1915 he was able to add 109 additional cases of unilateral tumor and 5 cases of bilateral tumor which made a total of 245 cases of unilateral acoustic tumor and 24 cases of bilateral acoustic tumor.[5] Of the 24 bilateral tumors 19 were associated with other evidence of von Recklinghausen's disease, and 5 of the unilateral tumors apparently were associated with this condition. This ratio of 1 bilateral to 10 unilateral tumors is far too large, according to Cushing,[6] who said that 1 to 100 or more would be a more probable ratio. In 1929 Gardner and Frazier [7] reported 62 cases of tumor of the cerebellopontile angle; in 2 of these cases the tumor was bilateral.

From the Section on Neurologic Surgery, the Mayo Clinic.

1. Wishart, J., cited by Cushing.[6]

2. Knoblauch, cited by Cushing.[6]

3. Henneberg and Koch, M.: Ueber „centrale" Neurofibromatose und die Geschwülste des Kleinhirnbrückenwinkels (Acusticusneurome), Arch. f. Psychiat. **36**:251-304, 1902.

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5. Henschen, F.: Zur Histologie und Pathogenese der Kleinhirnbrückenwinkeltumoren, Arch. f. Psychiat. **56**:20-122, 1915.

6. Cushing, H.: Tumors of the Nervus Acousticus, and the Syndrome of the Cerebellopontile Angle, Philadelphia, W. B. Saunders Company, 1917.

7. Gardner, W. J., and Frazier, C. H.: Bilateral Acoustic Neurofibromas, Tr. Am. Neurol. A. **55**:187-223, 1929.

The bilateral lesion is usually part of widespread neurofibromatosis (von Recklinghausen's disease) and may be associated with a hereditary background, as shown by Gardner and Frazier [7] in their careful study of a family of five generations, including 217 members. There was bilateral deafness in 38 members, and 15 of these subsequently became blind. It was noted that headache and vomiting preceded the blindness in each case. The evidence obtained from the living relatives led these authors to regard bilateral acoustic neuroma as the prevailing lesion.

Preiser and Davenport [8] collected 30 cases of a familial type, in which 2 or more members of a family were affected. According to them the disease seems to reappear in both sexes of successive generations in accordance with the mendelian law. They have considered a defect in the germ plasm as a probable explanation; under an appropriate stimulation this leads to the production of a tumor.

Hoekstra [9] in 1922 also collected a large series of cases which illustrated a hereditary tendency.

In 1932 Minski [10] reported 3 cases in the same generation; in 2 of these bilateral acoustic neuroma was associated with generalized neurofibromatosis, and in 1 there was neurofibromatosis of the spinal cord.

Acoustic tumors may occur early in life, as shown by the case reported by Berggrün [11] in 1897 in which a child had bilateral acoustic neurofibroma at the age of 11 years. They are more common in adult life, and both sexes seem to be equally affected.

Tumors of the cerebellopontile angle which involve the acoustic nerve comprise approximately 10 per cent of all intracranial neoplasms and are thought to originate from the sheath of the acoustic nerve (Geschickter [12]). Henschen [4] was the first to call attention to the fact that the growth often originates from that part of the nerve within the internal auditory canal which arises from the vestibular segment which is at times associated with a dilated porus acusticus. Gardner and Frazier [7] also demonstrated this. Roentgenographic studies of the skull when the tumor is of sufficient size reveal the dilated porus acusticus.

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8. Preiser, S. A., and Davenport, C. B.: Multiple Neurofibromatosis (von Recklinghausen's Disease) and Its Inheritance, with Description of a Case, Am. J. M. Sc. **156**:507-540, 1918.

9. Hoekstra, G.: Ueber die familiäre Neurofibromatosis mit Untersuchungen über die Häufigkeit von Heredität und Malignität bei der Recklinghausenschen Krankheit, Virchows Arch. f. path. Anat. **237**:79-96, 1922.

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Grossly, these tumors vary from 2 to 8 cm. in length and are oval. They are usually grayish yellow but vary according to the amount of fibrous tissue and fatty degeneration present. Their surface may be smooth and glistening or nodular and dull; at times they indent the sides of the medulla and the pons. They are always encapsulated; they may be soft, fluctuant and cystic or firm and fibrous.

According to Stout [13] they develop in the epineurium or the perineurium, and their subsequent position in respect to the nerve depends largely on the size and complexity of the nerve involved. The nerve bundles as such are never found inside the capsule of the tumor, but irregular, slender, tangled axis-cylinders usually pass into the superficial part of the tumor, that is, the part lying immediately beneath the capsule. The capsule is well supplied with blood vessels, which usually do not penetrate into the growth in many areas; therefore, if the capsule is split the tumor may in some cases be shelled out without the ligation of many vessels.

According to Antoni,[14] two types of neoplastic tissue are observed under the microscope. In one type there is a tendency for the wire-like reticular fibers to be massed in certain places in close parallel array, so that the nuclei come to lie in orderly alinement at the opposite extremities of the group of fibers. Ordinary stains produce the effect of a band devoid of cells at either end, which is a row of nuclei. This is called the palisading of the nuclei. Broad bands of collagen may occur among the fine fibers. The other type has no orientation of the fibers or cells. It is loose in texture, owing in part to an intercellular collection of fluid which separates the cells and fibers, and it often is the result of the collection of fluid products of degeneration into microscopic rounded cystic spaces. Collagen fibers are rarely found. It is the absence of the bands of collagen and the axis-cylinders and the presence of microscopic evidence of degeneration which cause this type of tissue to differ from the tissue composing the usual neurofibroma of von Recklinghausen.

These tumors are subdural and extracerebellar; they lie within a subarachnoid capsule, over which vessels travel on their way from the basilar artery to parts of the cerebellum. Since the lesions are bounded in front by the pyramidal bone, above by the tentorium and below by the posterior fossa of the skull medially, they may as they increase in size encroach on the cerebellar hemisphere, the brain stem and the nerves in the cerebellopontile angle. The resulting tension may cause bulging of the third ventricle, pressure absorption of the dorsum sellae,

13. Stout, A. P.: The Peripheral Manifestations of the Specific Nerve Sheath Tumor (Neurilemoma), Am. J. Cancer **24**:751-796, 1935.

14. Antoni, N. R. E., cited by Stout.[13]

obstructive dilatation of the ventricles or papilledema of the optic disks. The cerebellar tonsils may be forced through the foramen magnum and around the medulla to the level of the lower border of the second cervical vertebra.

The syndrome of a unilateral lesion of the cerebellopontile angle is as a rule not difficult to recognize. The earliest symptoms are usually those of a lesion of the auditory nerve, progressive unilateral nerve deafness, which is often preceded or accompanied by tinnitus in the corresponding ear. When the vestibular fibers are involved, vertigo appears and there is impairment of thermic nystagmus. Occipitofrontal headaches may be present. There may be signs of cerebellar disease, such as an ataxic gait on the affected side. By its contiguous relationship the facial nerve may be involved, and hemilateral facial paresis may be present. As the tumor enlarges it extends forward toward the pons or downward toward the medulla oblongata. In this manner other cranial nerves on the same side as the lesion, such as the fifth and sixth cranial nerves, may become affected. There may be diplopia as a result of pressure on the sixth nerve. Irritative phenomena or anesthesia of the tissues innervated by the trigeminal nerve may be present. One of the earliest signs of trigeminal involvement is loss of the corneal reflex on the side corresponding to the lesion. Later symptoms, resulting from pressure on the pons and medulla, consist of dysarthria, dysphagia, cerebellar crises and respiratory failure.

The clinical picture in cases of bilateral acoustic neurofibroma may be the result of pressure in both cerebellopontile angles and the consequent signs and symptoms. Sometimes the symptoms are confusing and a diagnosis of bilateral tumor can be made only in the presence of bilateral deafness. This need not be complete deafness, as is shown in 1 of our cases and in the case reported by Bassoe and Nuzum.[15] A large tumor may be present, and hearing may be preserved, at least in part. Still more confusing is the bilateral involvement of other cranial nerves, possibly due to dislocation without the pressure of a bilateral tumor. The contralateral symptoms may be more pronounced as far as the fifth and seventh nerves are concerned, and the diagnosis must rest primarily on the presence of bilateral deafness.

REPORT OF CASES

CASE 1.—A woman aged 35 registered at the Mayo Clinic on June 29, 1936, complaining of tinnitus aurium, bilateral deafness and a staggering gait. About six years prior to her registration she had noticed a roaring sound in the left ear, which had progressed until she became deaf. One year later the same thing had occurred in the right ear. Tinnitus had been continuous. In 1929 she had had

15. Bassoe, P., and Nuzum, F.: Report of a Case of Central and Peripheral Neurofibromatosis, J. Nerv. & Ment. Dis. **42**:785-796, 1915.

occasional occipital headaches, which lasted several minutes. About this same time she had had difficulty in walking in a dark room and had noted that she staggered both to the right and to the left. In 1932 there had been occasional diplopia and difficulty in swallowing with regurgitation of food into the nose. There was no family history of von Recklinghausen's disease.

General examination revealed a rather well developed woman who had multiple soft firm nodules about the jaw. A tender mass was present in the right upper quadrant of the abdomen. This was anterior to, and moved independently of, the kidney. Neurologic examination revealed bilateral nystagmus when the patient looked to the right or to the left, complete bilateral deafness, bilateral weakness of the seventh cranial nerve, bilateral corneal anesthesia, an ataxic gait both to the right and to the left and a Romberg sign on both sides. Examination of the ocular fundi revealed pallor of the temporal part of the right optic disk and a papilledema of 2 to 3 diopters in the nasal part of the left optic disk. The visual fields were roughly normal. Examination of the ears, nose and throat did not show anything other than complete deafness. Tests of the hearing and the equilibrium showed no response in either labyrinth. Roentgenographic studies of the skull revealed early erosion of the tip of the petrous portion of each temporal bone. A preoperative diagnosis of diffuse neurofibromatosis with bilateral acoustic neuroma was made.

On July 7 a bilateral cerebellar craniotomy was performed. Both cerebellar tonsils were herniated to the level of the first cervical vertebra. Moderate tension of the dura over the cerebellum was noted, and for that reason the posterior horn of the right lateral ventricle was drained. The dura was incised, and on elevation of the left cerebellar lobe a small encapsulated tumor in the cerebellopontile angle was exposed. The capsule was split and partial intracapsular enucleation performed. Microscopic examination of the tissue revealed a neurofibroma. A similar tumor, slightly larger, was found on the right side, and a partial intracapsular enucleation was done. The postoperative condition was unsatisfactory, and the patient died on the fourth postoperative day.

The postmortem observations were most interesting and not only explained the surgical and postoperative difficulties but brought up the question of why the patient did not have more symptoms.

The dura over the entire brain was peppered with multiple firm grayish white tumors, some of which were as large as 1.2 cm. in diameter (fig. 1). There were several to the square inch, and there probably were several hundred over the entire surface of the dura. Several similar tumors were found in the falx cerebri. The entire base of the cranial cavity was similarly involved, particularly by the tumors arising from each eighth cranial nerve. This type of tumor apparently involves and penetrates the petrous portions of the temporal bones. The tumor on the left side measured 3 by 2 by 2 cm., and the one on the right measured 2 by 1.5 by 1.5 cm. There also was a similar small nodule which apparently did not arise from, but impinged on, the right optic nerve. This nodule was slightly softer than usual and measured 1.5 cm. in diameter. The brain was found to be indented in the various portions from which the dural tumors arose. A neurofibroma was found on the left musculospiral nerve. A similar nodule was found on the intercostal nerve at the anterior axillary line in the third intercostal space; this nodule was 5 mm. in diameter. The spinal cord was removed, and the cauda equina was found to contain many small nodular enlargements, some of which were as large as 3 mm. in diameter (fig. 2). The second lumbar nerve on the right side contained an ellipsoid enlargement about 1 cm. in diameter.

CASE 2.—A housewife aged 37 registered at the clinic because of generalized intermittent headaches, weakness of the right hand, lumps about the face and body, tinnitus in the left ear, the loss of the sense of smell and failing vision in the left eye. Twenty years previously she had been troubled with daily generalized intermittent headaches, which had been associated with tinnitus in the left ear. The headaches had been present every day. Ten years before she came to the clinic there had been a gradual onset of weakness in the right hand, which had progressed for several years and then had become stationary. This had been associated with some atrophy of the muscles of the hand. Eight years before she came to the clinic small bean-sized lumps had been noticed over the left side of

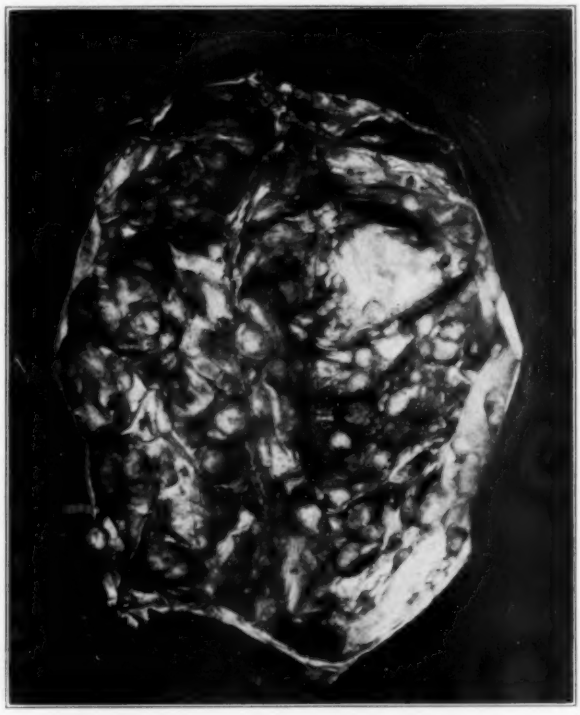

Fig. 1.—Photograph of the bone and dura over the cerebral hemispheres, revealing multiple meningeal tumors associated with extensive disseminated neurofibromatosis.

the face and the left elbow. There also had been a gradual onset of deafness in the left ear. Five years later, vertigo had appeared; this had been continuous and progressive. The onset of deafness also had been noted in the right ear. She had been aware of a gradual loss of the sense of smell on the left side and later on the right. She had had occasional blepharospasm in the left eye and soon afterward had noticed a gradual loss of vision and slight protrusion of the left eyeball. The left side of the mouth had become paralyzed. There was no family history of von Recklinghausen's disease.

General examination revealed a hard, freely movable mass, 1 by 1.5 cm., in front of the left ear. There also was a small pea-sized nodule behind the left ear, and many other small nodules were scattered over the body. The neurologic examination revealed bilateral anosmia, bilateral nystagmus when the patient looked to the right or to the left, bilateral deafness and a moderate degree of weakness in the left side of the face, the right arm and the right hand. The corneal reflex was diminished on both sides. There was ataxia to the right and to the left, and the Romberg sign was present on both sides. Examination of the ocular fundi revealed papilledema of 3 diopters. The visual fields were normal.

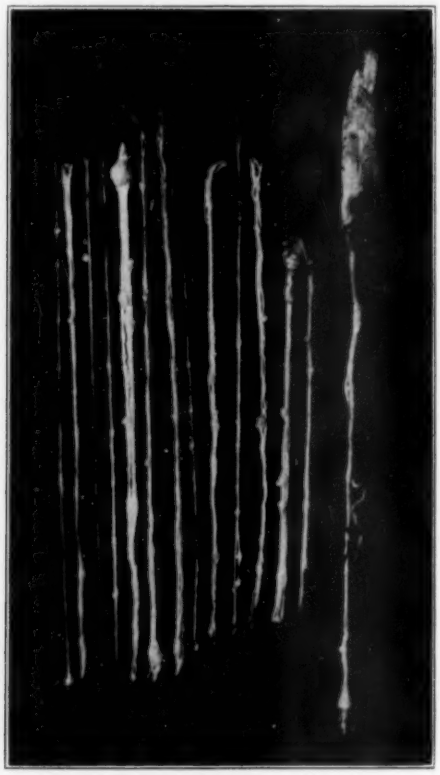

Fig. 2.—Multiple neurofibromas on the conus medullaris and nerve fibers, which compressed the cauda equina.

Roentgenographic studies of the skull revealed that the sella turcica was enlarged and that there was erosion of the floor and of the posterior clinoid processes. A preoperative diagnosis of diffuse neurofibromatosis with bilateral acoustic neuroma was made, and a bilateral cerebellar craniotomy was carried out. The posterior horn of the right lateral ventricle was tapped, and the dura was incised. Nodular tumors could be seen lying in both cerebellopontile angles. Because of the high degree of choked disk and the general condition of the patient a palliative decompression was done. After the operation the headaches gradually subsided. When the patient was dismissed the choked disk was receding. The patient was last

heard from one year after the operation; she said that she had been free from headaches and that her condition had not progressed. The palliative suboccipital craniotomy had been followed by subsidence of the choked disk and relief of headache; there had been little progress of the other symptoms.

This, of course, brings up the question of palliative versus more radical surgical procedures in cases in which bilateral acoustic tumor is associated with diffuse neurofibromatosis.

COMMENT

Bilateral acoustic neurofibromas are comparatively rare and are almost always associated with von Recklinghausen's disease, or generalized neurofibromatosis. The difficulty associated with surgical removal of the tumors in the first case, as well as the widespread distribution of associated tumors elsewhere in the intracranial cavity and body, suggested the palliative treatment as carried out in the second case.

PARALYSIS OF THE INFERIOR OBLIQUE MUSCLE FOLLOWING THE CALDWELL-LUC OPERATION

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Paralyses of the ocular muscles are frequently encountered in the practice of ophthalmology and otolaryngology. Paralysis of the external rectus muscle is the most common of these, and paralysis of the superior oblique muscle is next in frequency. Isolated paralysis of any of the remaining four muscles is much less common. Combined paralysis of some or all of the four muscles supplied by the oculomotor nerve is common.

Paralysis or paresis of the inferior oblique muscle, however, is exceedingly rare, and few ophthalmologists or otolaryngologists have observed a case of isolated paralysis of this muscle.

Nevertheless, it is conceivable that involvement of the floor of the orbit in periostitis, osteomyelitis or direct trauma to the muscle at its point of attachment may produce paresis or paralysis of the inferior oblique muscle. Before going into the consideration of the causative mechanism and the sequence of events in such an involvement, however, it is advisable to review the anatomy and the physiology of this muscle.

Dr. Luther C. Peter, in his textbook on extraocular muscles, remarked:

> The inferior oblique muscle has its origin at the anterior inferior angle of the orbit, from a shallow depression on the orbital floor, close to the outer side of the lacrymal fossa which houses the lacrymal sac. The muscle, somewhat flattened, passes backward underneath the inferior rectus, to which it is quite intimately attached by fibrous bands, and is inserted into the posterior hemisphere of the eyeball by a short tendon 2.6 mm. long. The line of insertion is in the posterior hemisphere making an angle of 25 degrees with that of the superior oblique. . . . It is supplied by a branch of the third nerve which enters the muscle about the middle of its posterior border. From eyes front, the inferior oblique elevates the eye, turns it out and rotates the upper end of the corneal meridian out (extortion).

Regarding the action of the ocular muscles, I again quote Dr. Peter:

> Individual ocular muscles never operate singly, but in response to innervations in which several or all muscles share under the coordinating influence of the brain. Only the external and internal recti operating singly are capable of rotating the eye about an axis perpendicular to the visual axis. The individual action of the

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other muscles, because of their peculiar attachments and the direction of their muscle planes, if operating individually will rotate the globe about an axis far from the perpendicular. Acting, however, under innervational influence and cerebellar coordination, movements are executed by the combined action of several muscles about an axis which is always perpendicular.

Motion of the eyeball, therefore, is never under the influence of a single muscle. Even external or internal rotation involves the combined action of three muscles. Thus, in rotating the eyeball toward the nose the internal rectus is assisted by the superior and the inferior rectus muscles, while in the rotation of the eyeball toward the temple the external rectus muscle is aided by the superior and the inferior oblique muscles. The muscles which help the major muscle in the execution of its function are called synergists.

The synergists to the inferior oblique muscle are the superior rectus and the external rectus muscles. Thus, in the act of rotating the eyeball upward and outward from "eyes front," the inferior oblique, as the major muscle, is assisted by the superior rectus and the external rectus, the former pulling the eye upward while the latter pulls it toward the temple.

In the action of a group of muscles to bring about rotation of the eyeball in a given direction further arrangements occur in the relation between the major muscle and its synergists. A muscle which in the initiation of this motion assumed the role of a major one may, in the course of this combined action, become a synergist, and vice versa. Thus, in rotating the eyeball upward and toward the temple the inferior oblique muscle, originally the major muscle, soon transfers the major role to the superior rectus muscle and in turn assumes the role of a synergist. This transfer of function occurs at the stage in which the eyeball is in the position of external rotation, at which point the superior rectus muscle acts at its maximum as an elevator. The inferior oblique muscle, at this point, diminishes in power and acts merely as a synergist.

A muscle may, furthermore, act as a synergist and an antagonist to the same muscle and at the same time. Thus, in the primary action of elevation of the eyeball, the inferior oblique muscle acts not only as a synergist but also as an antagonist to the superior rectus muscle and thus prevents the latter from rotating the eyeball inward (intortion).

The muscles of the one eye are conjugate with those of the other, and the action of the muscles of the one eye is associated with the action of the muscles of the opposite eye. It is by virtue of this delicate arrangement that binocular single vision is possible. Disturbance in this relation (such as occurs, for example, in a case of paralysis of the ocular muscles) immediately throws this delicate mechanism out of balance, and diplopia, or double vision, results.

Paralysis or paresis of an ocular muscle may be caused by various conditions in or about the eye. For the purpose of this paper, however, it is sufficient to state that in most cases this paralysis is due to disease or injury to the muscle or to the nerve supplying it.

Injury to an ocular muscle during intranasal manipulation or in the course of an operation on any of the paranasal sinuses is not uncommon.

Such accidents have been reported in the literature. De Schweinitz reported a case of paralysis of the internal rectus muscle following an intranasal operation.

Dr. L. C. Peter had 2 cases of paralysis of the ocular muscles due to operative trauma. One was a case of paralysis of the internal rectus muscle following exenteration of the ethmoid cells on that side. The other case was one of paralysis of the inferior oblique muscle following excision of the lacrimal sac.

Greenwood has reported a case of ocular palsy which occurred in the course of tampon treatments in the nose.

Disturbance of the function of the superior oblique muscle is a common occurrence in operations on the frontal sinus. In most instances full function returns. Occasionally paresis persists.

This discussion is principally concerned with an injury to the inferior oblique muscle, with resulting paralysis, which occurred after an operation on the maxillary sinus.

This complication, so far as I know, has never been reported in the literature, and it will therefore be described in detail in the following case reports.

REPORT OF CASES

CASE 1.—M. S., a woman aged 29, was admitted to the Graduate Hospital of the University of Pennsylvania on Oct. 22, 1935, with a complaint of constant aching across the forehead.

About twelve years previously the patient contracted a head cold. This lingered for a long period, and relief was obtained only intermittently. When she finally sought the advice of a physician she was told that her trouble was due to a sinal infection. A tonsillectomy, removal of both middle turbinate bones and a polypectomy were advised and done at safe intervals, but without any relief for the patient. Later she went to Germany and there consulted an otolaryngologist. Further surgical treatment was thought advisable, and a Caldwell-Luc operation was performed on the right maxillary antrum. This also failed to effect relief. She came back to the United States with her condition as bad as it was before any surgical treatment was attempted.

Examination on admission revealed a high septal deviation with a spur on the left side. The left nasal fossa was filled with a thick purulent discharge and with polypi. A window into the antrum was found on the right side. The temperature, pulse rate and respiratory rate were within the normal limits. Roentgenologic examination of the paranasal sinuses revealed the presence of pansinusitis.

Further surgical treatment was considered advisable. A bilateral intranasal ethmoidectomy was performed with the area under local anesthesia. About ten days later the left antrum was opened and was found to be full of foul-smelling

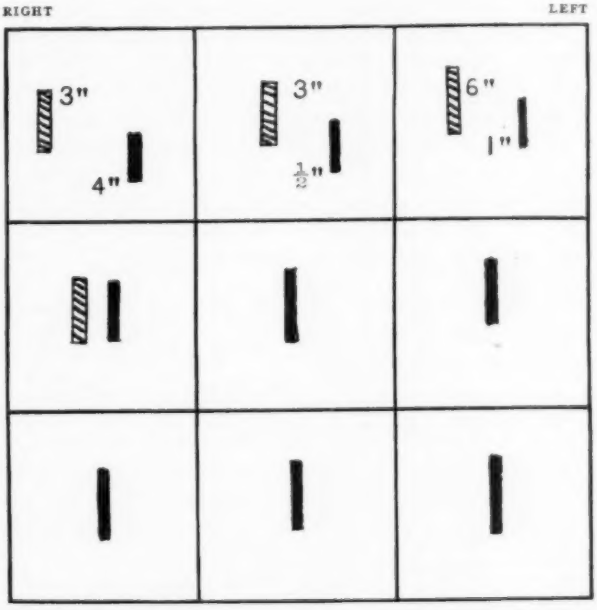
pus and hyperplastic mucosa. This was cleaned out, the usual Caldwell-Luc technic being used. On the fourth day after the operation the patient began to complain of double vision when she looked up and out to the left.

The ophthalmologist who was called in consultation made a diagnosis of paralysis of the left inferior oblique muscle.

To rule out the possibility of osteomyelitis of the orbit, which could involve this muscle, a roentgenogram was taken of this area. The report showed that osteomyelitis was not present.

In the meantime, the patient became accustomed to the diplopia and found it less troublesome.

On Nov. 11, 1935, a radical operation on the frontal sinuses was performed. Both frontal sinuses were again found to be full of foul-smelling pus. The mucosa, as in the antrum, was hyperplastic. A few small polypi were removed.



Results of tests made with a red glass over the patient's left eye, at a distance of 1 meter. The shaded column indicates the false image; the solid column, the true image.

The diplopia gradually lessened, and it disappeared entirely. Ophthalmologic examination on December 10 showed the absence of diplopia. The patient's distant vision had 3 degrees of esophoria and 1 degree of hyperopia. For near vision she had 3 degrees of exophoria and no hyperopia.

An interesting feature in this case is the type of diplopia. As will be noticed from the chart, the patient had crossed diplopia. Ordinarily paralysis of the vertical rectus muscles, that is, the superior and the inferior, produces crossed diplopia, while involvement of the oblique muscle produces the homonymous type. This is modified in the presence

of, and varies with the preexistence of, esophoria and exophoria. In this case ophthalmologic examination after the complete disappearance of the diplopia revealed the presence of 3 degrees of exophoria. This condition probably existed before the operation on the antrum, and consequently paralysis of the inferior oblique muscle resulted in crossed, instead of homonymous, diplopia.

CASE 2.—J. P., a man aged 36, was admitted to the hospital on Nov. 1, 1935, with a complaint of the chronic nasal discharge of a thick, foul-smelling pus. The condition had been in existence for many years previous to his admission. A thorough diagnostic study revealed the presence of chronic bilateral maxillary sinusitis.

In view of the chronicity of the condition an external operation on the antrums was considered the method of choice. A bilateral Caldwell-Luc operation was performed in one stage, and an unusual amount of hyperplastic tissue and polypi was removed from each antrum. Except for the usual swelling of the soft tissues over the antrums the patient showed no ill effects from this operation.

On the third day after the operation, however, the patient began to complain of discomfort in the left eye when he attempted to look upward and outward to the left. Diplopia was present when the eyes were rotated in that direction.

This condition had lasted but two days when improvement followed. On the seventh day after the operation the patient was discharged from the hospital, free from the diplopia and the discomfort he complained of.

This case, I believe, should be considered as one of paresis of the inferior oblique muscle rather than one of paralysis, because of the transitory nature of the condition.

In searching for an explanation of this complication I was unable to find one that was conclusive. My opinion is, however, that it was caused by operative trauma. Examination of the dry skull shows that next to the nasal wall the superior, or orbital, wall of the antrum is the thinnest and most vulnerable. A sharp curet can easily penetrate this wall and enter the orbit. The removal of the diseased tissue from the anterior internal angle of the superior wall of the antrum cannot be accomplished under direct vision, and penetration of the wall at this area will not be detected. Furthermore, dehiscences may be present in this part of the roof of the antrum, and the curet can easily enter the orbit and injure the muscle.

As an argument against this possibility one might stress the infrequency of occurrence of the complication. I believe, however, that it is more prevalent than is realized. The patient may not be annoyed by its presence sufficiently to bring it to the attention of the surgeon. Then again, the swelling of the soft tissue may close the eye on the side of the operation, and no difficulty may be noticed even in the presence of injury to the inferior oblique muscle. In the case of injury to an ocular muscle diplopia is experienced only when binocular vision is attempted in the field of action of this muscle.

In reporting these 2 cases I wish to emphasize the possibility of this complication's following a Caldwell-Luc operation. I have called attention to the ease with which the superior antral wall can be penetrated by a curet during the removal of the diseased lining. A thorough radical operation on the antrum is tedious and difficult, especially in the presence of partial septum and a sharp upper angle. Yet to perform a successful operation it is imperative to remove all the diseased tissue present in the antrum. It is necessary, however, to be extremely cautious and painstaking in the manipulations.

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Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

THE PARANASAL SINUSES

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CHICAGO

(Concluded from page 293)

OSTEOMYELITIS

Behrens [117] presents a thorough review of osteomyelitis with an analysis of the various factors as brought out in recent literature and offers a detailed report of 7 cases observed personally. He finds that the exciting cause is usually trauma, either operative or accidental, or acute exacerbation of a chronic infection with the staphylococcus as the most frequent offender. Most patients are under 30, and women are affected more frequently than men. Swimming also has been recorded as a common exciting factor. Direct infection of canaliculi and medullary spaces following trauma such as curetting infected bone is frequently noted in the pathogenesis. It has been found also that infection spreads by way of venous channels from the sinal mucosa to the extradural and the subdural spaces. Retrograde thrombophlebitis is often present. The author divides osteomyelitis into localized and spreading. The former spreads slowly in the region of the initial lesion and tends to localize, suppurate and sequestrate early. Also it is diagnosed early by roentgen examination and is amenable to conservative treatment. In the spreading type the pathologic condition is often ahead of the roentgen findings, and the high mortality is due to meningitis, sepsis and cerebral abscess. Statistics show that attacks developing postoperatively are more serious than those developing spontaneously. A study of these serious attacks serves to emphasize the danger of operative intervention in cases of acute infection of a sinus. When it is imperative to open the frontal sinus in such cases, it is important to avoid stripping the periosteum, curetting the bone and suturing the wound too closely. The author is in favor of radical surgical intervention for the rapidly spreading type of osteomyelitis and recommends transfusions, both preoperative and postoperative.

119. Schmidt, H.: Osteomyelitis der platten Schädelknochen, insbesondere der Sinus Origin, Arch. Otolaryng. **25**:272 (March) 1937.

On the basis of the observation of 13 cases at the Mayo Clinic, Williams and Heilman [118] recognize three types of osteomyelitis: fulminating, localizing and spreading. In 4 cases the fulminating type ended fatally with meningitis. Three patients recovered from localizing attacks after protracted illnesses with final extrusion of large sequestrums. In 6 cases of the spreading type, 4 patients recovered and 2 died. The fulminating variety usually follows swimming and is characterized by violent onset, severe pains and headache, high fever, spreading edema and early involvement of the arachnoid and the cranial venous channels. In cases of this type the authors advise a small incision over the inner angle of the brow with a trephine opening into the frontal sinus for drainage. No other surgical intervention is permitted until the patient shows evidence of acquiring resistance to the infection. In cases of the localizing type the initial advance is followed by evidence of healthy barriers thrown up, and it is wise to wait until the infection is well walled off and the bone sequestrates before operating. In cases of the spreading type a variable degree of resistance is manifested but no tendency to localization. Such attacks are best treated by radical surgical intervention, especially if there are signs of involvement of the venous sinuses. After the bone is removed, if a fistula is found in the dura the area should be drained by the method of Le Maitre. Drainage of an abscess of the frontal lobe should be done through a clean field if possible. The authors find that inflammatory changes in the dura are a better guide of the extent to which bone should be removed than is the edema over the forehead. The authors "prefer a cutaneous incision along both eyebrows, connected over the bridge of the nose, extending slightly beyond the external angular process of the frontal bone on both sides and then turning sharply backward and upward into the scalp."

Schmidt [119] made an extensive histologic study of 12 cases. He stresses the importance of Breschet's veins in the spread of osteomyelitis. These veins anastamose in the frontal bone just above the frontal sinuses. The author proves that the veins cross the bony sutures even in childhood before ossification is complete. Being contained within the bone itself, they consist of but a single layer of endothelial cells. The arterial blood supply is rich on both sides, the arteries anastomosing across the midline. The arterioles empty directly into the venous channels without any intermediate capillary bed. Since small arteries are discharging into large veins, the blood stream is slowed, and the stasis predisposes to infection. The veins in turn empty into the large cranial sinuses, and,

118. Williams, H. L., and Heilman, F. K.: Spreading Osteomyelitis of the Frontal Bone Secondary to Disease of the Frontal Sinus, Arch. Otolaryng. **25:** 196 (Feb.) 1937.

119. Schmidt, H.: Osteomyelitis der platten Schädelknochen, insbesondere der Stirnbeins, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **143:**117, 1937.

since the communications are small, stasis is again encountered. Furthermore, the bone marrow spaces encroach closely on the sinal cavity at the upper pole and the temporal recess, which are sites of predilection for extension of infection from the sinuses. As the author's sections show, there is no tendency to granulation in the bony spaces; therefore, the spread of infection is not easily halted. Thrombosis and emboli are frequent. Subperiosteal and epidural abscess are due to rupture of infection in the marrow by way of veins of preformed channels. Clinically the author recognizes a stormy and an indolent type, either of which may be primary or secondary, the former being post-traumatic and the latter spontaneous. His idea of the treatment of the spreading type is to break the connections in the blood stream by removal of diseased bone well into healthy areas. The incisions recommended are similar to those mentioned by Williams and Heilman. In most cases the author sutures the flap back to the nasal root and the orbital margins. Only in rare stormy attacks is the wound left entirely open. Drainage is usually effected at the angles. In the 12 cases reported, only 2 patients died. The histories and results of examinations are given in detail.

Adson and Hempstead [120] state that the surgical principles involved include (1) adequate drainage of the frontal sinus, (2) removal of pus, necrotic bone and all white dead bone, (3) preservation of the periosteum if possible and (4) concealment of the incision within the hair line. The technic they have successfully employed consists of a coronal incision above the hair line and reflection of a flap of soft tissue downward, so that the entire frontal area is exposed. The diseased bone is removed widely into clean, healthy, bleeding bone; the posterior wall of the frontal sinus is removed from behind, and the anterior wall is left intact unless obviously diseased. The cavity is packed with gauze, which is gradually removed over a period of days, so that the dura and brain are permitted to fill the space and obliterate the frontal sinus. The entire surgical field is swabbed with tincture of iodine at the conclusion of the operation before the packing is inserted. Preservation of the periosteum is important in the protection of the dura and the subsequent formation of new bone.

On the basis of Stewart's reports of the successful use of trinitrophenol with precipitated calcium carbonate in the treatment of osteomyelitis of long bones, Gray [121] reasoned that the same treatment should

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120. Adson, A. W., and Hempstead, B. E.: Osteomyelitis of Frontal Bone Resulting from Extension of Suppuration of Frontal Sinus, Arch. Otolaryng. **25**:363 (April) 1937.

121. Gray, H. J.: Picric Acid-Calcium Carbonate Treatment (Stewart) of Osteomyelitis Applied to Ear and Nose Condition, Ann. Otol., Rhin. & Laryng. **46**:681 (Sept.) 1937.

be useful in cleaning up postoperative discharge from sinuses and mastoids recently subjected to operation or any discharge caused by infected bone. The treatment is based on the discovery that maggot therapy of osteomyelitis is effective because the maggots exude calcium carbonate from their bodies, which possesses a stimulating effect on phagocytosis. Since, however, bacteria secrete leukocidin, or exotoxin which destroys phagocytes, Stewart conceived the idea of using trinitrophenol to render the leukocidin insoluble. The treatment for discharging cavities consists of a spray of 0.25 per cent solution of trinitrophenol containing 8 per cent glycerin, which is followed by an irrigation or spray of precipitated calcium carbonate, 20 Gm. to 215 cc. of distilled water.

Hill [122] compares the treatment of osteomyelitis in 2 cases, fourteen and seventeen years ago with that in 2 recent cases to illustrate the advances in the conception of the disease and its therapy. In the older cases the condition fortunately was not of the spreading type, but the patients were nevertheless subjected to several operative procedures before the lesions healed. In those days reliance was placed on roentgen findings for surgical indications whereas today it is realized that the roentgen findings are several days behind the spreading pathologic condition, and greater reliance is therefore placed on the local findings, particularly the pitting edema.

Arellano [123] lays stress on the differential diagnosis of the localizing and the spreading type and attaches value to signs of sepsis as an indication of the latter.

Leroux [124] gives the usual résumé of history, pathologic anatomy, paths of spread, histology and clinical course. He recognizes the circumscribed, the typical spreading, the septicemic and the postoperative type. He discusses Furstenburg, Mosher, Jason, Dixon and others and seems to find himself confronted with a divergence of opinion as to the indications for delayed or conservative as against early and radical treatment. He says, "It is easy to say that one will be conservative in the cases in which there is a spontaneous tendency to limitation and radical in the cases of spreading forms, but in the beginning of an osteomyelitis one cannot know how the condition is going to develop." Since postoperative osteomyelitis has been found to be far more serious than the other types, the author is inclined to support Mosher's idea of surgical attack wide of the apparently infected area. When spontaneous osteo-

122. Hill, F. T.: Osteomyelitis of the Skull, Arch. Otolaryng. **26**:9 (July) 1937.

123. Arellano, E. R.: Diagnostico de los tepos clinicos de la osteomielitis del frontal y su importancia clinica, Vida nueva **39**:381 (June 15) 1937.

124. Leroux, L.: Ostéomyélitis envahissante de l'os frontal, Ann. d'otolaryng., December 1936, p. 1255.

myelitis develops during sinusitis one does not know how quickly the diploe will be involved, and there are chances that the condition will limit itself. One may have time to study and follow the case roentgenologically so as to determine these facts before resorting to surgical intervention. If the general condition of the patient is good, one may wait. If symptoms such as severe headache, chills, vomiting or convulsions appear, operation is imperative.

Mazza [125] reports an attack which terminated fatally and gives an extensive summary of the whole subject. He proved that in the case cited the infection passed directly from the sinal mucosa to the diploe, spreading from there via the diploetic veins as far back as the parietal bone. He favors conservative treatment, stating that efforts should be confined to drainage of subperiosteal abscess and removal of dead bone.

The Bergaras [126] present a study of osteomyelitis of the superior maxilla in infants and report 4 cases. The condition is rare, comprising 9.5 per cent of all attacks of osteomyelitis in the faciomaxillary region and occurring only 7 times in 15,000 cases of nasal suppuration. The pathogenic factors are the great vascularity of the poorly calcified bone of the newborn, the large number of dental follicles which are the seat of great activity in infancy and the frequency of nasopharyngeal infections with poor drainage. Osteomyelitis of the superior maxilla is a destructive medullary process in which the periosteum participates. It is characterized by venous thromboses, sequestration, exfoliation of dental follicles and the formation of fistulas.

The local origin of the infection may be lacrimal through an extension from purulent ophthalmia, buccal from a fall or other trauma, or from infection of the dental follicles, or nasal from acute coryza or sinusitis. In addition to general symptoms, such as fever, convulsions and diarrhea, there are local signs, such as nasolabial swelling, edema of the lids, profuse salivation, fetid odor, infiltration of the alveolar border and edema of the buccal mucosa. A fistula may develop in the alveolar border, the internal angle of the eye or the nasal fossa. Probing may reveal denuded or movable fragments of bone. Sequestrums may be extruded spontaneously, with relief of acute symptoms, or the condition may continue for a long time with acute exacerbations. The treatment is surgical for the purpose of removing sequestrums and providing drainage. Incision may be made into discharging fistulas or through the alveolar recess. Curetting should be avoided and as little trauma inflicted as possible.

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125. Mazza, A.: Consideracoes un turno de um caso de osteomielite crancana secundaria a um processo de sinusite frontale, Rev. oto-laryng. de São Paulo **4**:995 (Sept.-Oct.) 1936.

126. Bergara, R., and Bergara, C.: Contribución al estudio de la osteomielitis del maxilar superior en la primera infancia, Rev. Asoc. méd. argent. **50**:1819 (Oct.) 1936.

Lawson [127] reports 2 cases of osteomyelitis of the sphenoid bone. The first case was that of a child of 8 years, and the attack followed otitis media and operation on a mastoid. Symptoms of complications appeared four weeks later, the patient having been discharged as cured in the interim. Fever, otorrhea, diplopia and pain in the eye were noted. Nine days later, the temperature rising and other symptoms continuing unabated, the wound was reopened and the perilabyrinthine and peritubal cells cleaned out; forty-eight hours later basilar meningitis developed, and the child died. Autopsy showed osteomyelitis involving the petrous tip and extending to the body of the sphenoid.

The second case was that of a woman of 33, whose condition also started with otitis media and mastoiditis, after which pansinusitis developed, believed by the author to be an exacerbation of an old condition and resulting in thrombosis of the jugular bulb, the tributary basilar veins and the veins of the neck, with abscesses appearing in the postcervical spaces, which were drained. Autopsy revealed necrosis of the sphenoid and the ethmoid. The author believes with Pickworth [128] that bacteria in attenuated form may reside for a long time in the sphenoid bone and become activated through lowered resistance or trauma. The 2 cases reported are unusual in the absence of thrombosis of the cavernous sinus, which is usually considered a constant finding.

Bozzi [129] reports a case in which an infection of the ear developed after adenoidectomy, with symptoms of sepsis and localized meningitis suggesting petrositis. Autopsy revealed osteomyelitis arising from the nasopharyngeal wound, which involved the sphenoid bone, extending into the petrous tip and forward into the ethmoid. The diagnosis was in doubt because of the infection of the ear, which was considered the primary focus. (No mention is made of roentgen studies, which might have helped in the differential diagnosis and disclosed the origin of the process. This point is well developed by Otto Mayer.[130])

SURGICAL THERAPY

General Consideration.—A comprehensive reading of the literature offers Montgomery [131] the following reasons for the failure of surgical

127. Lawson, L. J.: Osteomyelitis of the Sphenoid Bone, Arch. Otolaryng. **25**:1 (Jan.) 1937.

128. Pickworth, F. A.: Organisms in Chronic Bone Infections of the Sphenoid, J. Laryng. & Otol. **50**:206 (March) 1935.

129. Bozzi, E.: Osteomielite dello sfenoide e della rocca petrosa da adenotomia in individuo affetto do otomastoidite acuta, Arch. ital. di otol. **49**:395 (Aug.) 1937.

130. Mayer, O.: Die Pyramidenzelleneiterungen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **42**:1, 1937.

131. Montgomery, D. C.: Is Surgery Effective? Mississippi Doctor **15**:52 (Aug.) 1937.

intervention in the sinuses: (1) failure to make a complete study of the patient and to eliminate all etiologic factors; (2) presence of allergy complicating an infection; (3) too much or too little operation in relation to the patient's resistance and general condition; (4) failure to bear in mind the fact that the sinuses cannot be obliterated as can other diseased organs and that there is therefore a tendency to recurrence and reinfection; (5) insufficient attention to diet, endocrine factors and intestinal status.

Ford [132] attributes much of the failure of surgical intervention in the sinuses to lack of standardization of operative procedures and confusion in the minds of recent graduates and newcomers in the field. A multiplicity of operations with varying indications makes for indefiniteness and incompleteness. Lack of complete understanding of the individual cases, lack of thorough study and incomplete knowledge of the pathologic condition are definite factors leading to the wrong type of surgical procedure. The author recognizes the importance of allergy, the recognition of which will certainly decrease the number of operations being done. Other causes for headache, including constitutional factors, must be ruled out before resorting to surgical intervention in the nasal region. The author relies on good roentgenograms properly interpreted for his diagnosis of the pathologic condition.

Tivnen [133] reviews the anatomy of the sinus and offers some general observations on the objectives of surgical procedures. His trend is generally conservative. He prefers the burr in his external operations and in the extreme winter months would like to postpone surgical procedures of a radical type, especially if epidemics of colds, "Flu" and other diseases of the respiratory tract are present. The author does not discuss technic but stresses the value of roentgen studies.

McLaurin [134] lists sixteen conditions requiring radical surgical intervention but objects to the term "radical." He would substitute the word "complete" to indicate the removal of all diseased tissue. He believes that when sinusitis fails to yield to adequate conservative treatment and interferes with the patient's activities a complete operation should be performed. The patient's history is of equal importance with the physical findings, since the subjective symptoms must vary with different temperaments. In cases of hyperplastic sinusitis in which an allergic factor is present, radical operation should not be performed until the allergic or other constitutional factors are eliminated. At most the larger polyps should be removed for temporary relief while the patient

132. Ford, H. L.: Ill-Advised Nasal Surgery, Illinois M. J. **72**:540 (Dec.) 1937.

133. Tivnen, R. J.: Surgery of the Nasal Accessory Sinuses, S. Clin. North America **17**:393 (April) 1937.

134. McLaurin, J. G.: Indications for Radical Sinus Surgery, South. M. J. **30**:633 (June) 1937.

is undergoing general treatment. Frequently the treatment will be successful and further surgical intervention unnecessary.

Pansinal Operations.—McKenzie's [135] technic is a combination of the transantral approach to the ethmoid cells and the sphenoid sinus with certain intranasal procedures. He rarely finds it necessary to open the frontal sinus. Should the indications point to involvement of the frontal sinus, the author would advise a separate external incision. He gives a preliminary hypodermic injection of morphine sulfate and atropine sulfate, and anesthesia is maintained by oxygen and ether administered through a breathing tube. The nasopharynx is blocked off with packing. The middle turbinate is infracted and the anterior ethmoid cells cleaned out in the usual manner. An L-shaped incision is then made in the alveolar recess for the approach to the antrum. After all the mucosa of the antrum is removed the posterior ethmoid cells and the sphenoid sinus are opened and cleaned out by way of the antrum. A large opening in the inferior meatus is then made into the nose and the entire cavity packed. In a series of 200 patients thus treated 107 (53.5 per cent) were cured, 84 (42 per cent) were considerably improved, 6 (3 per cent) were improved and 3 (1.5 per cent) died. Of the 3 fatalities, 1 was due to the anesthesia, 1 to the circulatory collapse of an elderly asthmatic patient twenty-four hours after operation and the third to paralytic ileus. The author advises operating on both sides, when indicated, at one sitting. The procedure takes from two to four hours.

The technic followed by Abad, Brion and Antonio [136] in 150 cases with excellent results consists of a Caldwell-Luc operation in combination with an external approach for the frontal sinus and the anterior ethmoid cells. The usual Caldwell-Luc technic is followed except for the counter-opening in the inferior meatus. The bulla, the uncinate process and the ethmoid cells are cleaned out by way of the antrum and a large opening into the nose left in the middle meatus. The frontal sinus is then opened externally through a small incision along the root of the nose and the sinus cleaned out. Through this opening the most anterior of the ethmoid cells can be reached and exenterated. A superficial drain is then inserted and the frontal incision closed with a clip. The ethmo-sphenoidoantral cavity is packed with iodoform gauze from behind forward as far as the gingival incision, which is not sutured. The packing is removed by the sixth day, after which the wound in the mucous membrane closes spontaneously. Moderate swelling is combated by hot dressings wet with saline solution. The author says that

135. McKenzie, W. R.: Chronic Sinusitis: A Complete Operation; Technique and Results in Two Hundred Consecutive Cases, South. M. J. **30**:1077 (Nov.) 1937.

136. Abad, L. D.; Brion, E. G., and Antonio, J. C.: Pan-Sinus Operation, J. Philippine Islands M. A. **17**:235 (April) 1937.

the advantages of this method are that it shortens the patient's stay in the hospital and achieves complete eradication of all the sinuses of one side at one sitting. If the other side is involved it may be operated on about two weeks after the first.

Daito [137] uses an external approach to the frontal sinus and the ethmoid cells which resembles the Lynch operation. He depends on the roentgen findings for his indications but also stresses the fact that persistent headaches, a sensation of pressure and a feeling of weight usually mean involvement of more than one sinus.

Operations on the Maxillary Sinus.—Andre and Grove [138] show the feasibility of general anesthesia for the radical operation on the antrum; 106 patients operated on by the procedure to be outlined all recovered without complications. The usual premedication of morphine sulfate for adults and codeine for children is administered thirty to forty-five minutes before operation. Atropine is given only occasionally. Induction of nitrous oxide anesthesia is followed by administration of ether up to the point of relaxation sufficient to permit insertion of the gag. The anesthetist then follows the open method, employing the Gwathmey gas-ether apparatus, "using mainly nitrous oxid-oxygen, small amounts of ether vapor being added only when absolutely necessary to keep the patient quiet." The authors advise the Davis-Crowe gag and the Rose position. The nasopharynx is packed off. This method of anesthesia has been successfully employed in operations about the mouth lasting up to two hours and a half. The importance of the postoperative care is stressed. The patient is turned on the side soon after the operation and supportive treatment administered for shock or loss of blood.

Lucas [139] believes the rhinologist is incompetent to treat sinusitis due to extension from a diseased tooth and that such a condition should be handled by the oral surgeon! He recommends preliminary removal of dead teeth and curettage of pathologic pockets, with sufficient time allowed postoperatively for complete closure of the pockets. This is then followed by a modified Caldwell-Luc operation under intratracheal cyclopropane anesthesia.

An incision is made from an area corresponding to the region of the apices of the maxillary third molar, downward to within 3 mm. of the free margin of the gingivae, then forward to the lateral incisor and upward to its apical region.

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137. Daito, T.: Polisinusectomia e pan-sinusectomia nelle sinusite paranasali croniche, Arch. ital. di otol. **49**:97 (March) 1937.

138. Andre, R. H., and Grove, R. C.: General Anesthesia in Allergic Patients: Review of Three Hundred and Forty-Six Cases of Tonsillectomy and Radical Antrum Operations, Anesth. & Analg. **16**:65 (March-April) 1937.

139. Lucas, C. D.: Empyema of the Maxillary Sinus: Operation and Treatment, J. Am. Dent. A. **24**:620 (April) 1937.

The mucoperiosteum . . . is elevated with a periosteotome from the line of incision upward to a plane 5 mm. below the infra-orbital foramen, exposing the facial surface of the maxilla.

A window is made in the bony wall about 1.5 by 3.5 cm. well above the apexes of the maxillary teeth. The sinus is cleaned out and frozen sections made for diagnosis, and after thorough hemostasis and cleansing the floor is searched for diseased bony areas. When found, they are curetted and touched up with 95 per cent phenol and 70 per cent alcohol. The nasoantral wall is treated as in the usual Caldwell-Luc operation. The author advocates irrigations with a solution of sodium perborate through the nasoantral window, drying and insufflation of iodoform powder.

Schupfer [140] maintains that in treating an edentulous patient with a large cyst one must consider the effect of a Partsch operation in relation to proper fitting of a denture. He describes such a case in which a modified Denker operation was done with a flap of nasal mucosa laid into the cyst, the incised external wall of which was resutured. Thus the cavity was directed nasally rather than orally. The wall or capsule of the cyst was left intact, and the contour of the jaw was not affected. The denture was therefore more readily fitted than would have been possible had the cyst been exenterated orally and packed, as is the usual procedure.

Farjat [141] objects to the sublabial approach to the antrum because of the damage to the vessels and nerves in the anterior wall of the antrum with consequent anesthesia and paresthesia. He advocates the intranasal preturbinal approach as modified by Halle, the incision being carried from the floor of the nose in front of the inferior turbinate as high as the level of the middle turbinate. Otherwise the technic is as described by Canfield, Skillern, Theobald and others.

Childrey [142] would use the term "cristectomy" to designate the intranasal operation in which the piriform crest is removed. He feels that this procedure should supplant the sublabial approach except in cases of polyp, tumorous disease of bone or infection secondary to dental caries. The author asserts that the operation can be done in the office, a statement that many rhinologists might be disposed to dispute. In the main, he follows the technic described by Hempstead and Wachsberger and uses no packing. The principal object is to provide permanent

140. Schupfer, C.: Zur Indikation rhinologischer Operationsmethoden bei grossen Zysten des zahnlosen Oberkiefers, Ztschr. f. Stomatol. **35**:1165 (Sept. 10) 1937.

141. Farjat, F. P.: Consideraciones sobre la radical operación de la sinusitis maxilar según el método endonasal de Max Halle, Rev. Asoc. méd. argent. **50**: 1839 (Oct.) 1936.

142. Childrey, J. H.: Cristectomy: Permanent Window in the Antrum for Chronic Maxillary Sinusitis, Arch. Otolaryng. **26**:448 (Oct.) 1937.

ventilation and drainage without disturbing the lining membrane of the sinus. It is especially recommended for the cure of chronic alveolar fistulas following extraction of a tooth. Postoperative irrigations are omitted, and the sinus is kept clean by suction through a cannula. No statistics are given.

Porta [143] describes Skillern's technic, which he favors because of its simplicity, the short duration of the procedure and the accessibility of the wound for postoperative treatment. He points out the differences in the thickness of the piriform crest according to the size and development of the sinus and suggests various instruments to meet the conditions.

Asherson [144] advises continuous drainage when the condition is acute with much swelling and pain. The sinus is punctured with a special trocar and cannula under anesthesia induced by nitrous oxide and oxygen. The cannula is left in place up to a week. It may be removed and replaced every few days. Frequent hot saline irrigations (a pint or more) afford much relief. The cannula is provided with strings which are fastened to the face with adhesive tape. It is made by Mayer and Phelps of London.

An unusual complication following a Caldwell-Luc operation is described by Fuller.[145] The patient was a woman of 35 who was operated on because of a chronic infection following removal of a tooth. Recovery was uneventful, but ten months later the patient returned with complete hemifacial atrophy. No explanation was available, since the operation was free from much local trauma and the postoperative reaction minimal. The author believes the process was due to infection in the tissues activated by trauma of the operation. He states that hemifacial atrophy, beginning in a small area and gradually extending to involve all the tissues of the face, has been observed in young adults. Local infections, such as tonsillitis or alveolar abscess, have been known to precede the condition.

Tsugawa [146] observed a case in which within twenty-four hours after a Denker operation on a 30 year old woman the cheek became edematous and red. This swelling spread downward to the neck. On the tenth day fluctuation was evident and confirmed by exploratory puncture, which

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143. Porta, C. F.: Considerazioni sopra l'apertura del seno mascellare per via nasale col metodo preturbinale di skillern, Oto-rino-laring. ital. **7**:332 (Aug.) 1937.

144. Asherson, N.: Intubation of the Maxillary Antrum for Acute Empyema, Lancet **1**:1399 (June 12) 1937.

145. Fuller, T. E.: An Unusual Complication Following a Caldwell-Luc Operation, J. Arkansas M. Soc. **34**:94 (Oct.) 1937.

146. Tsugawa, S.: Zur Kasuistik des postoperativen Wangenabszesses, Oto-rhino-laryng. **10**:230 (March) 1937.

yielded fluid from which Streptococcus haemolyticus was obtained by smear and by culture. Incision and drainage were followed by recovery.

Operation on the Frontal Sinus.—Goldberger [147] finds many cases of frontal headache due to impaired ventilation which is caused by a hypertrophied uncinate process bulging medially and closing the hiatus. He describes the relation of the turbinal bulla and the uncinate process and goes into the details of differentiating them by means of probing. He believes that amputation of the anterior end of the middle turbinate in such cases is not entirely without danger and prefers to remove the uncinate process. This is done with a Kofler sphenoid punch the bite of which may be directed downward and outward as it is hooked over the posterior end of the uncinate process. Successive bites are taken from behind forward until the area is cleaned. This method is less dangerous than the use of scissors or hooks and provokes less bleeding.

Aubin and Maduro [148] state that the essentials of a successful frontoethmoid operation are (1) to permit thorough exploration of the frontal sinus and complete exenteration of pathologic material from the ethmoid sinus, (2) to leave a good cosmetic result and (3) to provide permanent intranasal drainage. The greatest difficulty in most of the approaches investigated is in the maintenance of a permanent nasofrontal passage. Three methods of overcoming this difficulty are prolonged intubation, the use of flaps of mucous membrane and keeping the external wound open, according to Hajek's suggestion, until the duct is well established and then doing a secondary closure. The authors prefer a combined intranasal and external operation, since they are able in this way to preserve the nasal portion of the frontal floor, thus insuring the intactness of the duct. In cases of bilateral involvement they favor the Lothrop or the Sibeleau procedure. The former is less dangerous than the latter. Failures are attributed to the following factors: (1) incomplete operation, (2) error in adapting the operation to the pathologic condition, (3) local or general conditions unfavorable a priori, (4) reinfection of the sinus on which operation has been performed and (5) inadequate postoperative treatment.

Parrish [149] believes that the intranasal frontal operation is applicable in about half the cases requiring surgical intervention. In all cases in which the condition is chronic there should be a preliminary removal

147. Goldberger, K.: Die Bedeutung der processus Uncinatus in der Behandlung der Stirnhöhlenerkrankungen, Monatschr. f. Ohrenh. **71**:175 (Feb.) 1937.

148. Aubin, A., and Maduro: Etude critique du traitement chirurgical des sinusites fronto-ethmoidales de l'adulte (Indications et techniques operatoires), Oto-rhino-laryng. internat. **20**:730 (Nov.) 1936; Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:654, 1937.

149. Parrish, R. E.: The Present Status of Frontal Sinus Surgery, Texas State J. Med. **33**:52 (May) 1937.

of all obstructions to drainage and treatment or operation for associated infection of the ethmoid sinuses or the antrum. The author agrees with Good's indications for the external operation but adds the following to his list: (1) chronic suppurative conditions failing to yield to the preliminary procedures in which pain and tenderness persist in addition to profuse discharge; (2) acute conditions in which intranasal drainage is blocked, for relief of which an external opening must be made with the trephine just below the supraorbital margin, and (3) compound fractures of the sinuses or foreign bodies in the sinuses. When the internal table has been fragmented, he advises obliterating the sinus to prevent meningeal infection.

The type of operation selected depends on the size of the sinus. A large sinus requires an opening above the ridge as well as below. The frequency of osteomyelitis after external operations is mentioned. Failures are attributed to inadequate removal of diseased tissue, collapse of soft tissues around the duct and cicatricial contraction of the duct. The author comments on the use of Sewell's flap but believes that the procedure will not be taken up by many operators.

Ledoux [150] reviews the methods of surgical approach, both external and intranasal, giving the advantages and disadvantages of each. He has a schematic drawing showing the various procedures.

The author describes in detail his two stage operation, which is both external and intranasal. The latter is done first and consists of exposing the margin of the piriform aperture, peeling off the periosteum down to the lacrimal groove and the mucoperiosteum on the inner surface and removing the ascending process of the superior maxilla. This exposes the agger nasi cells and permits exenteration of the ethmoid sinuses. The second stage, or external operation, consists of the removal of three strips of bone radiating fan shape from the external wall of the frontal sinus with elevation of periosteum only over the areas of bone removed so as to permit resuture. These three gutters into the sinus meet at the internal angle of the brow, where the removal of bone extends down to join the intranasal breech and also encompasses removal of the intersinal septum. The first opening into the bone is made with a Doyen drill and enlarged with Dalgreen's forceps. The author cautions against using hammer and gouge or forceps which crush the bone, since these procedures may lead to infection of the diploe. Two drains are used, one at the external angle of the wound and the other intranasally. Postoperative irrigations with dilute solution of hydrogen peroxide are kept up for fifteen days, during which time the patient is kept in the hospital. Epithelization takes place by this time, and the drains are removed. The patient is sent home with

150. Ledoux, L.: La cure radicale de la sinusite fronto-ethmoïdale purulente chronique, Bruxelles-méd. **17**:611 (Feb. 21) 1937.

instructions to irrigate the cavity several times a day. A dilute solution of chromic acid (3 parts in 1,000) keeps the granulations down and facilitates epithelization. In cases in which the frontal sinus and the ethmoid cells but not the antrum are involved, operation can be done in two stages within a few days or at one sitting if the patient's resistance is good. In cases of unilateral pansinusitis, a Caldwell-Luc operation is included in the first stage. Bilateral pansinusitis requires a bilateral intranasal and Caldwell-Luc operation; eight days later the second stage, or external operation, is done.

Rezende [151] favors the Lothrop operation as described by Sibeleau for bilateral frontal sinusitis because of the excellent cosmetic results and gives the anatomic data and technical details. Four cases are cited.

Le Roux [152] states that any operation which reduces to a minimum the amount of bone removed is satisfactory provided the pathologic condition is adequately dealt with and provided also that the following factors are taken care of: 1. Adequate intranasal drainage must be provided for by preliminary resection of the septum. 2. The anterior ethmoid cells, particularly those about the agger nasi, must be cleaned out and the anterior end of the middle turbinate removed. It is not necessary to exenterate the ethmoid labyrinth. In fact, this procedure may even prove harmful. 3. Constitutional disturbances must be corrected.

Van den Wildenberg [153] favors the combined external and internal operation as described by Aubin and Maduro and cites several cases in which operation was previously performed elsewhere by the external route alone and a discharging fistula persisted.

Guns [154] is much impressed by the Matis method of intranasal subperiosteal operation on the frontal sinus and reports a case in which this operation was performed with complete cure and a broad communication with the nasal cavity. He believes the operation is particularly adapted to a large frontal sinus.

Operations on the Ethmoid and Sphenoid Sinuses.—Ferreri [155] strongly advises preserving the middle turbinate for the following reasons: 1. The dangerous zone along the attachment of the middle turbinate where it joins the roof near the cribriform plate is avoided. 2. The region of the sphenopalatine ganglion is preserved from trauma.

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151. de Rezende, M.: Operação de Lothrop-Sebileau para cura das sinusites frontais cronicas bilaterais, Rev. oto-laring. de São Paulo (no. 5, bis) **4**:935 (Sept.-Oct.) 1936.

152. Leroux, L. N.: Des conditions nécessaires au succès des opérations sur le sinus frontal, Ann. d'oto-laryng., July 1937, p. 625.

153. van den Wildenberg: Sinusites frontales fistulisées, Bull. Soc. belge d'otol., rhin., laryng., 1937, p. 48.

154. Guns: La méthode sous-périostée dans la cure des sinusites frontales chroniques, Bull. Soc. belge d'otol., rhin., laryng., 1937, p. 56.

155. Ferreri, G.: Conservazione del durbinato medio nell'operazione di etmoido-sphenoidotomia, Valsalva **13**:1 (Jan.) 1937.

3. Hemorrhage from the sphenopalatine artery is prevented. The author advises cutting the turbinate free at a safe distance below its insertion and extending the cut backward so that the turbinate hangs by its posterior end. The usual technic of exenteration of the cells and the sphenoid sinus follows, and at the conclusion of the procedure the turbinate is pushed back into place and retained by a tampon, which is left in place for three to five days. Care must be exercised in its removal.

Simpson [156] gives a detailed description of the external radical operation, which is an elaborated procedure based on the work of Jansen, Knapp and Lynch and which in the main is similar to that described by Sewell, Ferris Smith and Luongo. Such differences as are noted among these authors pertain only to the treatment of the nasofrontal duct, the question of flaps of mucous membrane and the method of drainage. Simpson insists on complete removal of mucous membrane from the sinus, including the nasofrontal duct. He favors ligating the sphenopalatine artery when exenterating the sphenoid sinus. He does not favor using a flap of mucous membrane or keeping the duct open by probing, but relies on complete exenteration of the ethmoid cells. The middle turbinate is left in place. Occasionally a separator is passed between the turbinate and the lateral wall of the nose to break up adhesions. Diplopia was rarely encountered and was only transitory. Osteomyelitis, meningitis, prolonged suppuration or cosmetic deformity did not occur in any of this author's cases.

De Lima [157] prefers the transmaxillary to the ethmoid and sphenoid route and credits Laurent (1889) with being the first to suggest it. The advantages are based on the assumption that frequently the maxillary sinus is likewise affected; the one procedure is then adequate. Also it is easier by this method to expose all the ethmoid cells, reaching many that are difficult to approach by the intranasal route. The usual Caldwell-Luc operation is done with particular care to open widely enough medially to facilitate the approach to the anterosuperointernal angle. The osteum is enlarged and the uncinate process and the posterior end of the middle turbinate removed. The bulla is easily curetted and the agger nasi and frontoethmoid cells opened. After the posterior cells are entered the orbital plate is exposed and is easily followed backward so that the sphenoethmoid cell, if present, can be located and differentiated from the sphenoid sinus proper. The author concludes the operation with the usual counteropening in the inferior meatus. (In this operation the last procedure is not always necessary, since the large opening in the middle meatus is sufficient for drainage as well as for ingrowth of epithelium.)

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156. Simpson, W. L.: The Ethmosphenofrontal Operation, Arch. Otolaryng. **26**:270 (Sept.) 1937.

157. de Lima, E., and Penna, M.: Etmoido-sfenoidectomia transmaxillar, Rev. oto-laring. de São Paulo (no. 5, bis) **4**:965 (Sept.-Oct.) 1936.

NONSURGICAL THERAPY

General Consideration.—Van Alyea [158] reviews the progress of knowledge of the protective mechanism of the nasal passages, quoting liberally from most of the well known investigators, and discusses the factors which disturb this mechanism leading to the development of colds and sinusitis. He stresses the value of establishing ventilation and recommends the Parkinson position for the instillation of 1 per cent ephedrine in physiologic solution of sodium chloride.

Meyer [159] presents the startling thesis that chronic sinusitis is due to passive congestion, the result of chronic phlebitis of the internal jugular vein, and recommends the use of leeches along the course of the vein. No pathologic evidence is presented. The author asserts that the phlebitis may be diagnosed by tenderness to pressure over the vein and states that he has cured intractable sinusitis in several cases by one application of the leeches. No clinical records are given.

Physical Agents.—Tebbutt [160] conducted a series of experiments to determine the effect of local heat and cold on the temperature within the maxillary sinus. This was registered by means of a delicate thermopile connected with a registering galvanometer the readings of which had previously been determined experimentally. It was found that cold compresses, an ice bag, hot compresses, a hot water bottle or an electric heating pad caused no change of temperature within the antrum or the sphenoid sinus. A drop of 1 to 2 F. in the temperature of these sinuses was noted after the use of the infra-red lamp and the high frequency oscillating current. This is attributed to evaporation of increased nasal secretions which follow the use of these agents. The value of the treatment is attributed to the increased secretion with improved drainage.

For the relief of tension Snow [161] advises radiant heat (50 candle power lamp, carbon filament) usually at 3 feet (0.9 meter) for twenty to thirty minutes. It causes relaxation of surface tissues and increases phagocytosis. This is followed by diathermic treatment through electrodes of 22 gage composition metal. The exact details of the size and application of the electrodes are given in the article. The author seems to attach considerable importance to these details for the accurate application of the current to the various sinuses. Pledgets of cotton soaked

158. Van Alyea, O. E.: The Acute Nasal Infection: Local Therapy Based on the Modern Conception of Nasal Physiology, Illinois M. J. **72**:336 (Oct.) 1937.

159. Meyer, O.: The Etiological Treatment of Chronic Sinusitis, M. Rec. **146**:226 (Sept. 1) 1937.

160. Tebbutt, H. K., Jr.: Physical Agents in Relation to the Treatment of Nasal Sinusitis, Arch. Phys. Therapy **18**:479 (Aug.) 1937.

161. Snow, M. L. H. A.: Physical Therapy in the Treatment of Sinusitis, M. Rec. **145**:340 (April 21) 1937.

in a solution of metaphen and ephedrine diluted with warm water are placed in the nose, and a current of 200 milliamperes (d'Arsonval) is passed between the electrodes for about thirty minutes. This is followed by an intranasal application of ultraviolet rays from a water-cooled quartz mercury vapor arc lamp for ten seconds. In some cases the patient receives also a treatment to the body with both the carbon filament or the carbon arc lamp and an exposure to the ultraviolet lamp.

Troup [162] claims the type of condition most amenable to physical therapy is that in which there is no gross nasal obstruction, polyps or diseased tonsils. He finds also that infections with Str. haemolyticus are less favorable than those due to other organisms. The aims of physical therapy are (1) to relieve congestion, especially about the natural ostiums, (2) to improve circulation, thus purifying the blood supply to the mucous membranes of the sinuses, (3) to drain the infected secretions and (4) to restore the function of the ciliated mucous membrane. The author uses general ultraviolet irradiation, local applications of rays from the quartz lamp, local exposure to infra-red rays and short wave diathermy. (It is difficult to appraise accurately this treatment, as the author states that he uses adjuvants in the form of autogenous vaccines, colloidal manganese, intestinal lavage, corrected diets and vitamin B.)

Diathermy.—Short wave diathermy seems to be finding favor in the treatment of sinusitis whether acute or chronic. Talia [163] reports a number of successful results and shows roentgenograms taken before and after treatment. It is particularly effective in cases of maxillary sinusitis. One electrode is placed over the cheek and the other behind the occiput. For chronic conditions up to thirty treatments are given, the length of each treatment beginning with fifteen minutes and increasing up to thirty minutes. A wavelength of 7 to 8 meters is used. The author alleges also that much relief from pain results when the treatment is applied for frontal sinusitis.

Guarini [164] quotes the literature freely on the beneficial effects of short wave therapy, which he corroborates from his own experience. He mentions differences in opinion as to the size of the electrodes to be used. Also he calls attention to possible danger to the orbit and advises keeping the current away from it even though the treatment is at the same time recommended for ethmoid and sphenoid diseases. For acute conditions he has found five to six treatments sufficient; for chronic conditions as many as thirty treatments may be given.

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162. Troup, W. A.: Chronic Sinusitis: Its Treatment by Radiotherapy, M. Press **194**:482 (May 19) 1937.

163. Talia, F.: La Marconiterapia nelle sinusite croniche, Arch. di radiol. **13**:23 (Jan.-April) 1937.

164. Guarini, C.: La Marconi-terapia in oto-rino-laringologia, Rinasc. med. **14**:417 (June 30) 1937.

Leichner and Schmidt [165] report good results with this form of therapy in 50 cases of chronic disease, in 34 of which the diagnosis was confirmed roentgenographically. Twelve of the patients had been subjected to radical surgical procedures without relief, and the rest had been under more or less prolonged treatment with other measures. They used a 6 meter wavelength at 300 watts and administered fifteen minute treatments three times weekly. Acute conditions were treated daily. At the Jefferson Hospital these treatments were preceded by lavage with physiologic solution of sodium chloride. In some cases combined lavage and suction were used and in others the Proetz displacement method. They found a temporary increase in discharge at the onset with rapid subsidence as the treatments were carried on. Disappearance of pain was a characteristic result, observed in all cases. Thirty-nine of the patients were much improved, 11 moderately improved, 2 slightly improved and 3 not affected.

Fischel [166] uses substantially the same technic as described and mentions the appearance of a marked nystagmus in 1 case, which promptly subsided.

Rosenwasser and Bierman [167] recorded the intranasal temperatures after the use of short wave therapy produced by machines of 50,000,000, 20,000,000 and 18,750,000 oscillations at wavelengths of 6, 15 and 16 meters. The average increase in temperature was 1.31 F. The authors found, however, that the preliminary use of cocaine and epinephrine prevented the rise in temperature, which proves that the beneficial effects of short wave therapy are due to vasodilation.

Peters' [168] technic in treating hyperplastic or chronic catarrhal ethmoiditis is to apply a 10 per cent mild protein silver tampon high in the middle turbinal area and pass the diathermy current (250 milliamperes) through for twelve to fifteen minutes twice weekly. He states that the closed hyperplastic type with polypoid degeneration is not amenable to this therapy and requires surgical treatment.

Roentgen Irradiation.—Koch [169] contributes a valuable scientific article on the effects of roentgen therapy on sinusitis, which is supported by histologic studies as well as long-continued clinical observation. He

165. Leichner, R., and Schmidt, W. H.: Treatment of Sinus Infection by Ultra Shortwave Diathermy, Arch. Phys. Therapy **18**:488 (Aug.) 1937.

166. Fischel: La Marconi-terapia del trattaments delle sinusite chroniche, Verhandl. internat. Kong., 1937, p. 307.

167. Rosenwasser, H., and Bierman, W.: Effect of the Short Wave Current on the Temperature of the Paranasal Sinuses, Arch. Otolaryng. **25**:555 (May) 1937.

168. Peters, A. L.: Diagnosis and Conservative Treatment of Ethmoiditis, New Orleans M. & S. J. **89**:557 (April) 1937.

169. Koch, J.: Klinische und experimentelle Erfahrungen über die Roentgenbestrahlung akuter und chronischer Nebenhöhlenerkrankungen, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **143**:385, 1937.

quotes the literature extensively and devotes some space to Butler and Wooley's work. The technic he favors is that which has long been found successful in the treatment of tuberculous glands and tuberculous laryngitis, viz.: 120 kilovolts, 2½ milliamperes, filtered with 0.2 mm. of copper and 4 mm. of aluminum, with the tube at a distance of 30 cm. The field measures 8 by 10 cm., and the dose per field is 100 roentgens given once or twice. The rate of delivery was 11.3 roentgens per minute. In some later experiments with harder rays, a dose of 25 roentgens per minute was delivered. Twenty-two patients with acute sinusitis were treated, with 20 cures. All these patients had previously had the benefit of the usual conservative treatment without effect, and all of them were discharging purulent or mucopurulent secretion. Pain was relieved promptly after one treatment, and secretion diminished after the second treatment. One patient was not improved, and 1 had to be operated on. Twenty-eight patients with chronic sinusitis were treated with roentgen rays in combination with other measures; 17 of these were uninfluenced and had to be operated on. In all of them polypoid changes in the mucous membrane were found. The roentgen treatment, however, served to relieve pain and reduce the secretion. At operation it was found that the mucosa on the side which had been treated with roentgen rays was thinner than on the untreated side. Bacteriologic studies showed that roentgen rays did not diminish the bacterial count. The hydrogen ion concentration of the sinal secretions was studied before and after treatment. In 7 cases of acute sinusitis there was a shift from acid to alkaline reaction. In 7 cases of chronic sinusitis no definite changes could be determined.

Histologic examination of the sinal mucosa in experimental animals which were infected and then treated with roentgen rays showed early edema on the treated side with large numbers of plasma cells, the condition, however, regressing some time after the treatment. The author's conclusions are that patients with acute sinusitis can be helped by roentgen treatment provided there is no obstruction to drainage. This is particularly true when the condition is severe and accompanied by pain and swelling. Chronic sinusitis can be cured if there is simple hyperplasia. Cystic, polypoid, fibrous and hyperplastic conditions are uninfluenced. When pain persists after operation, the patient can be helped by roentgen rays provided new polyps have not formed. Polypoid ethmoiditis is not amenable to roentgen therapy.

Stevens[170] is enthusiastic over the beneficial effects of roentgen therapy in chronic disease of the tonsils and the sinuses on the theory that it promotes absorption of lymphatic tissue and induces shrinking of hyperplasia. No statistics are given.

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170. Stevens, J. T.: Evaluation of Roentgen Rays in Treatment of Chronic Infections, Arch. Phys. Therapy **18**:477 (Aug.) 1937.

Del Regato [171] records the results of roentgen therapy alone, used experimentally on 10 patients with epithelioma of the maxillary sinus treated at the Fondation Curie from 1919 to 1934. Five of the patients died. Four remained cured for periods of five to fifteen years.

Lucas [172] states that the amount of gamma radiation used in carcinoma of the antrum is dependant on three factors: (1) outer limits of the tumor, (2) radiosensitivity and (3) adjacent vital structures. He tries to get his radium as near the middle of the sinus as possible and inserts it in the center of a rubber sponge measuring about 3 by 3.5 cm., which is pushed into the cavity. Sensitivity is determined not alone by histologic study but also by clinical observation of the location of the lesion. The dose varies from 5 to 15 threshold erythema doses, depending on the factors mentioned. The author presents a scale for guidance, which gives the lethal dose for various types of tumor as well as for various sizes of antrums.

Ionization.—Dowling [173] uses copper electrodes of various sizes and shapes to permit passage into the antrum and the frontal and the sphenoid sinus. The negative pole is applied first, because it softens and dilates the ostiums, permitting free passage of probes. After one minute the current is reversed for three to ten minutes and then again reversed to the negative for one minute. A black deposit on the electrode indicates infection, according to Dowling, since it is not found in simple vasomotor or allergic conditions. He alleges that the copper electrode does not destroy cilia as does the zinc. He maintains also that the therapy is effective in all cases of low grade infection, neuralgia following operation on the antrum or sphenopalatine neuralgia. He believes ionization with the copper electrodes destroys pathogenic organisms, although no laboratory data are furnished in support of this statement.

Biologic Products and Chemicals.—Blotta [174] lauds the local use of an antivirus of the Besredka filtered bacteriophage type for acute sinusitis of infants. He maintains it is effective regardless of the duration of the infection, is nonirritating and nontoxic and acts both locally and constitutionally—locally by producing a lysis of the germs as well as by impregnating the tissue cells, making them more effective against bacteria, and constitutionally by stimulating the reticuloendothelial system with proteins liberated by lysis of the bacteria.

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171. del Regato, J. A.: Roentgentherapy in Epitheliomas of the Maxillary Sinus, Surg., Gynec. & Obst. **65**:657 (Nov.) 1937.

172. Lucas, C. DeF.: The Calculation of the Dosage in the Radium Treatment of Carcinoma of the Antrum, Radiol. Rev. & Mississippi Valley M. J. **59**:56 (March) 1937.

173. Dowling, J. I.: Preliminary Report of Copper Ionization, J. Am. Inst. Homeop. **30**:525 (Sept.) 1937.

174. Blotta, F.: Supuraciones nasales en la infancia: Trattamento biologico, Rev. méd. latino-am. **22**:1240 (Aug.) 1937.

Zambrini [175] believes that if lymphatic drainage can be promoted early inflammatory products will be carried off promptly, stasis overcome and resolution take place before tissue is destroyed. He attempts to accomplish this purpose by giving intravenous injections of a 20 per cent hypertonic saline solution twice daily. He also recommends injections of morphine sulfate for cellular inhibition. He reports that several patients with orbital cellulitis were cured by this procedure.

Encouraged by their success with nonspecific protein therapy in cases of acute otitis media, Sourdille and Loué [176] have been using it for acute sinusitis, with particularly good results. Their procedure is to put the patient to bed, using epinephrine or ephedrine as a nasal spray and giving hypodermic injections of a protein preparation. They maintain that relief from pain follows in twenty-four to forty-eight hours, cessation of discharge within two weeks and complete clearing of the sinus in less than a month. (One wonders whether the rest in bed and the local use of ephedrine were not the real factors in the cures reported.)

Koepke [177] believes that during acute infection the endocrine system, especially the adrenals, is under a strain; therefore, the patient is easily fatigued, and the condition is slow to heal. He advises giving vitamin A in a multiple concentrate and has never seen any toxic effects from its use.

Scal [178] reports a case of septicemia due to Str. haemolyticus, complicating suppurative otitis media and pansinusitis in a woman of 42. The patient was given prontosil soluble (the disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthelene-3′,6′-disulfonic acid) intramuscularly (5 cc.) twice daily and sulfanilamide by mouth (5 grains [0.32 Gm.]) three times daily until the temperature reached normal. The local infections as well as the septicemia cleared up, but metastatic arthritis was still under treatment.

Reuys [179] recommends the use of diaryldimethylaminomethylcarbinol for its local bactericidal effect in cases of acute sinusitis. The drug possesses slightly anesthetic and astringent properties also and is not irritating to the mucous membrane, as proved by the frequent dropping

175. Zambrini, A. R., and Gret, L. G.: Tratamiento biológico de los sinusitis agudas, Rev. argent. de oto-rino-laring. **6**:183 (May-June) 1937.

176. Sourdille, M., and Loué, A.: Sur 275 cas de suppurations aiguës otosinusiennes traitées en sept ans par la protéinthérapie, Ann. d'oto-laryng., February 1937, p. 137.

177. Koepke, G. M.: Vitamins and Infections of Eye, Ear, Throat and Sinuses, Journal-Lancet **57**:460 (Oct.) 1937.

178. Scal, J. C.: Septicemia Following Acute Sinusitis Treated with Sulphonamide Compounds, New York State J. Med. **37**:1147 (June 15) 1937.

179. Reuys, H.: Die Behandlung von Rhinitis vasomotorica und anderen entzündlichen Erkrankungen der Nase mit einem neuen Mittel (Xylindrin), Med. Klin. **33**:838 (June 18) 1937.

of a 2 per cent solution into the noses of guinea pigs over a period of twelve to fourteen days. It is claimed that the drug is effective against vasomotor rhinitis and acute sinusitis when instilled into the nose every three or four hours.

Wales [180] claims good results in both acute and chronic sinusitis from the use of mercurophen 1:8,000 dropped into the nose with the head extended. This is preceded by the local application of butyn and ephedrine for shrinking the sinal ostiums. The author does not use suction for displacement but asserts that the solution may be made to enter the frontal sinus and the ethmoid cells by tamping the forehead with the base of the palm for three minutes. If the head is raised until the forehead is higher than the chin, the author says, the medicine will flow into the maxillary and the sphenoid sinus. This procedure is followed by spraying with a preparation containing camphor, menthol, thymol, eucalyptol, methyl salicylate and hydrastine. For home treatment the patient irrigates the nose with warm saline solution and follows it with application of mercurophen twice daily. (Some of the statements made by the author regarding active treatment of acute conditions were challenged by Proetz, Lilly and Coates in the discussion.)

Miscellaneous Therapy.—On the basis of 11 clinical cases Arslan [181] attempts to justify his treatment of acute and subacute frontal sinusitis. He found that over 60 per cent of his patients could be catheterized without force. If necessary the anterior end of the middle turbinate may be removed, and if a large bullous cell or other anomaly blocking the duct is encountered the author advises breaking through by force in order to effect drainage. For this purpose he recommends a fine rasp devised by Vacher, which is inserted in the anterior part of the middle meatus and directed upward and slightly outward. In some cases it is necessary to use dilators to keep the nasofrontal passage open.

Day [182] suggests the use of extract of belladonna and phenyl salicylate by mouth as an aid to relieving nasal congestion in cases of chronic frontal sinusitis. Ephedrine is used locally by the displacement method. Vaccines have not been successful in the author's hands. When local conservative treatment fails, the author advises an operation described by Harmer. The anterior wall of the sinus is opened and a fine rubber tube passed down into the nasal cavity. The tube is left in place for one week and replaced with a larger size. This procedure is repeated with successively larger tubes until a caliber of 3/8 inch (1 cm.) is

180. Wales, E. de W.: Non-Surgical Treatment of Nasal Sinus Disease, Tr. Am. Laryng., Rhin. & Otol. Soc. **43**:271, 1937.

181. Arslan, K.: Sulla cura conservative delle sinusiti frontali, Arch. ital. di otol. **49**:329 (Feb.) 1937.

182. Day, L. F.: Paranasal Sinusitis, J. Malaya Br., Brit. M. A. **1**:65 (June) 1937.

attained. It is claimed that the duct thus dilated remains patent indefinitely. If the sinal mucosa is degenerated or polypoid this procedure will not suffice.

Schillinger [183] describes an apparatus with a graduated bottle which contains the fluid for irrigating or displacement. Suction and irrigation may be accomplished in one maneuver without removing the suction tip from the nostril.

CLINICAL ASPECTS

General Consideration.—Twelve years after his first announcement of displacement as a method of diagnosis, Proetz [184] presents a complete inventory of the procedure as practiced throughout the world and a résumé of the literature on the subject. The review embraces technic, types of solutions used, therapeutic values, roentgenographic interpretation and general diagnostic significance. Every rhinologist who is interested in this procedure must read the article in its entirety to appreciate its value. It is far too important and extensive to be abstracted adequately.

Silvers [185] offers a readable explanation for the layman of the causes of sinusitis and stresses the importance of general predisposing factors in its prevention, such as proper diet, fresh air, sunshine, vitamins and dust-free air. He seems to favor physical therapy and praises quartz lamps, violet rays, diathermy and ionization. Also he advocates surgical diathermy for removal of tonsils and other lymphatic tissue. These measures are perhaps a bit overstressed for the laity, especially in view of the fact that surgical treatment is not even mentioned.

Albright's [186] article is in the nature of a historical review of the development of knowledge of sinusitis and the various phases of its treatment. The general trend of the author's thought is toward conserving the functioning mucosa, with surgical intervention as a last resort.

Bryant's [187] remarks are along the same lines. He is impressed with the harmful effect of dry air or cold air on the ciliated epithelium and the connection between impaired ciliary function and diseases of the lower air passages.

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183. Schillinger, R.: An Apparatus for Displacement Irrigation of Nasal Sinuses, Arch. Otolaryng. **25**:84 (Jan.) 1937.

184. Proetz, A. W.: An Evaluation of the Displacement Method with a Review of the Literature, Ann. Otol., Rhin. & Laryng. **46**:699 (Sept.) 1937.

185. Silvers, L. J.: Sinus Disease, Hygeia **15**:794 (Sept.) 1937.

186. Albright, G. C.: Progress in the Management of Paranasal Sinus Disease, J. Iowa M. Soc. **27**:413 (Aug.) 1937.

187. Bryant, F. L.: Aural and Nasal Problems in General Practice, Journal-Lancet **57**:261 (June) 1937.

Creasy's [188] article was written for nurses and covers etiology, prophylaxis and some of the effects of disease of the sinus in relation to diseases of other organs. It is generally informative without being too technical.

Bateman's [189] views are generally in line with the ideas accepted in this country. He stresses the importance of conservative treatment for acute conditions and outlines the indications for radical surgical procedures much as they are taught here.

Hetler [190] studied the nutritional history of 300 patients of the otolaryngologic clinic of the Medical School of Washington University and found a high percentage of allergic phenomena among the patients with otitis media and sinusitis. Irregular habits in eating and lack of proper rest, relaxation and outdoor exercise also were common. The author was impressed with the frequent inadequacy of vitamins B and C in the diets of his patients.

> Some data . . . show that individuals with chronic infection have less vitamin C in the blood and urine than normal individuals who take the same amount of vitamin C in their diets. Also some data are presented to show that more vitamin C is needed by people with chronic infections than by normals to bring about an increase in the vitamin C content of the blood.

On the whole, a general improvement was found in the mucous membrane after the proportion of vitamin C in the blood had been increased for several months.

Sohval and Som [191] report 9 cases in which intermittent fever of obscure origin had lasted for weeks and months and various diagnoses had been made, such as rheumatic fever, infectious mononucleosis, typhus and subacute endocarditis. In all these cases the condition was cleared up by careful attention to chronic sinusitis, which in most of them had given little indication of its presence. The authors stress the value of careful roentgen studies and examination of fluids recovered from the sinuses after irrigation. The roentgenograms taken in their cases always showed some cloudiness, and the irrigating fluid revealed fine shreds or granular masses. Seldom was pure pus recovered. Headaches, which were at first attributed to the febrile state, disappeared after treatment. In only 1 case was an operation necessary.

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188. Creasy, R. C.: Interesting Phases of Sinusitis, Pub. Health Nursing **29**:588 (Oct.) 1937.

189. Bateman, G. H.: Some Observations on Nasal Sinusitis, St. Thomas's Hosp. Gaz. **36**:148 (July) 1937.

190. Hetler, R. A.: A Study of Nutrition in Relation to Infections of the Upper Respiratory Mucous Membranes, Ann. Otol., Rhin. & Laryng. **46**:629 (Sept.) 1937.

191. Sohval, A. R., and Som, M. L.: Masked Sinusitis as a Cause of Obscure Fever, Arch. Otolaryng. **25**:37 (Jan.) 1937.

Morwitz [192] emphasizes the following factors in the causation of sinusitis: (1) insufficient vitamin A (quoting Daniels and Cody), (2) allergy, (3) filtrable viruses, (4) swimming when in a state of fatigue and (5) exposure with chilling.

Burgess [193] points out the importance of evaluating postnasal discharge in the absence of a true purulent secretion from the sinuses. One must consider other causes than sinusitis, such as external stimuli to the sympathetic nervous system, which controls the secretion of the mucous glands, dust, smoke and allergy. Failure to recognize these possible contributing factors may lead to disappointment after surgical intervention in the nasal sinuses.

Buzoianu [194] finds that headache of nasal or sinal origin is due to one or more of the following factors: (1) functional disequilibrium in the nasal respiratory capacity—either hyperventilation or obstruction, (2) irritation of the trigeminal-sympathetic system and consequent alteration in the nasal vasomotor apparatus and (3) chronic intoxication of the entire organism. The nasal irritation produces a pathologic state of the mucosa, which is transmitted to the meningeal capillaries by way of the trigeminal tracts which constitute the vagonasal system. This system controls the tonus not only of the nasal vascular apparatus but of the endocranial membranes as well, which explains why relief is obtained from the local application of vasoconstrictors within the nose. The evidence of vagonasal hypersensitivity is to be found in (1) exaggeration of the nasofacial reflex, (2) increased vascularity of the middle turbinate and middle meatus, (3) presence of Ewing's tender point aside from the apparent nasal inflammation and (4) disappearance of symptoms in the head after application of cocaine to the middle meatus. The author dilates considerably on the mechanism of the trigeminal-sympathetic system in its relation to the nasal organism and the interrelationship between the tonus of the nasal vessels and that of the vessels of the meninges. He emphasizes the necessity for thorough investigation of the eyes, the nasal passages and the arterial and venous systems in cases of protracted and recurrent headache in order to evaluate the contributing factors. Many patients with headache seen in the neurologic clinic were relieved by attention to these factors and by local treatment, which in some cases included injections of alcohol into the sphenopalatine ganglion.

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192. Morwitz, S. M.: Acute Sinus Infection in Children and Adults, Illinois M. J. **73**:132 (Feb.) 1938.

193. Burgess, T.: Clinical Consideration of Paranasal Sinus Disease, J. M. A. Georgia **26**:411 (Aug.) 1937.

194. Buzoianu, G.: Observations cliniques sur la cephalee rhinogene, Arch. internat. de neurol. **56**:229 (May-June) 1937.

On the basis of autopsies on 40 of 60 children who had died of diphtheria in the Kharkow Hospital, Nathanson [195] states that the sinuses may harbor the Klebs-Löffler bacillus for a long time without giving evidence of local infection. He found 85 per cent of the group infected with Bacillus diphtheriae and other organisms, although only a few had a typical diphtheritic membrane in the antrum. The author asserts that he has disproved Zuckerkandl's statement that sinal mucosa is not capable of forming a membrane since it lacks "plastic power." The chief danger is not so much the neglect of sinusitis which presents few symptoms as the possibility of the patient's being a carrier. He advises that in every case of diphtheria the sinuses be investigated.

Antrum.—Guthrie [196] finds that reports from Chinese hospitals are rather vague on the subject of sinusitis, although he believes it must be frequent, judging by the large number of cases of "nasal catarrh" reported. He makes a plea for more detailed reports from his colleagues in China. As for diagnosis and treatment, he follows the usually accepted pattern of diagnostic puncture, repeated lavage and intranasal window operation and the Caldwell-Luc operation in cases of intractable involvement. In the last-mentioned cases he advises against removing any of the inferior turbinate unless it absolutely blocks drainage. He also emphasizes the need for a large opening near the floor of the sinus and speaks against postoperative lavage except for one irrigation two days after operation for the removal of clots and débris.

Buzoianu [197] reports 2 cases of suppurating antrums causing fistulas. In 1 case the fistula was located in the cheek, and in the other case there were two fistulas, one near the internal canthus and the other in the mouth, behind the last molar. Treatment naturally was directed toward cleaning up the sinus. The fistulas need not be touched, since they usually close spontaneously when the original focus is eliminated.

Sato [198] found disease of the antrum more frequently than suspected among the lower rank cadets of the Marine Academy. Telegraph operators thus affected were somewhat less efficient than those unaffected, and operative procedures on these men restored them to normal efficiency.

Maschkow [199] reports an interesting case of traumatic sinusitis. A young woman while picking cherries was struck in the right eye by a

195. Nathanson, A. M.: Les sinus paranasaux dans la diphtérie, Rev. de laryng. **58**:233 (March) 1937.

196. Guthrie, D.: Maxillary Sinusitis: Its Diagnosis and Treatment, Chinese M. J. **51**:371 (March) 1937.

197. Buzoianu, G.: Suppurating Fistulas Following Chronic Purulent Sinusitis, Cluj. med. **17**:721 (Dec. 1) 1936.

198. Sato, A.: Wie beeinflusst das Empyema Highmori die Arbeitsfähigkeit der Telegraphisten? Bull. Nav. M. A., Japan (Abstr. Sect.) **26**:47 (July 15) 1937.

199. Maschkow, E. F.: Fall eines in die Highmorsche Höhle durch die Orbita eingedrungenen Fremdkörpers, Vestnik. otol., 1937, no. 1, p. 81.

branch of the tree. A fistula below the lower lid resulted and was treated without improvement. Examination by probing and roentgen study showed that the fistula communicated with the antrum. A Caldwell-Luc operation disclosed three splinters of wood within the sinus. Recovery ensued.

Among several cases of primary dyscrasia of the blood with symptoms in the nose and throat reported by Trible [200] was 1 of mononucleosis with involvement of the antrum and the jaw. The illness began with an infection of the upper part of the respiratory tract followed by bronchopneumonia, debility and depression. An ischiorectal abscess appeared, which drained for a long time. Later the nose became stuffy, and headaches were frequent. There were loss of weight, fever and swelling about the face. Pus was found in the nasal cavity, and the antrum was dark. The blood count was as follows: 6,000 leukocytes, no polymorphonuclears and 10 large and 88 small lymphocytes. A dentist by digital manipulation removed three molars, which left a cavity leading into the antrum, which was filled with thick, bloody material. No reparative surgical procedures were attempted, but the patient was treated with blood transfusions and liver extract. In the author's experience pentnucleotide was less effective. He stresses the importance of examination of the blood in all cases of infection which fails to clear up promptly.

Chatellier [201] offers some suggestions as to treatment of teeth projected into the antrum. When the root of a tooth projects into an antrum or beneath its mucosa, having been broken off, the procedure will depend on whether or not the sinus is previously diseased. If diseased, the sinus should be treated according to the indications and attention then should be given to the tooth. This procedure may not always be easy, since the root of the tooth may be hidden in the recesses of granulation tissue. If the sinus was previously healthy, the question then would be: "Is the root of the tooth small and hard to locate, or is it large and accessible? Is the fragment actually within the sinus or just below its mucosa?" A fragment of root may disappear because of a bad maneuver with the elevator or a too vigorous tamponade. One should immediately explore the socket with the utmost gentleness to decide whether the fragment has completely disappeared. If discovered it should be grasped and removed. If necessary, the mucosa over the alveolus should be incised and the alveolar bone removed to afford a better view. Care must be taken not to open the sinus or to ram the root in deeper. If the root is not found, one should probe gently to see if the sinus has been penetrated. If so, the root must be within the

200. Trible, G. B.: Clinical Manifestations in the Nose, Throat and Sinuses in Diseases of the Mononucleosis Type, Tr. Am. Acad. Ophth. **42**:367, 1937.

201. Chatellier, J.: Projection d'une racine dans un sinus maxillaire, ou sous sa muqueuse: Conduite à tenir, Rev. de stomatol. **39**:634 (Aug.) 1937.

sinus. If not, then the root must be below the mucosa. If gentle attempts at removal are unsuccessful, one should examine the sinus roentgenographically, with or without iodized poppyseed oil. Rarely the root may be removed by irrigation. In most instances, however, if it is in the sinus, a transcanine opening is necessary. If the procedure is done promptly before the sinus is infected, healing will take place after primary suture.

In a case reported by Katsuta [202] the canine teeth failed to erupt. Roentgenograms revealed them symmetrically placed in the posterior upper part of the alveolar process on a level with the first incisor. The directions of the crown and root were normal. There were no subjective symptoms.

Frontal Sinus.—Hyperostosis frontalis interna as a manifestation of various forms of neuropathic dyscrasia is the subject of several articles that appeared in the foreign literature. Since there is much confusion in nomenclature and uncertainty as to causation, it is difficult often to identify the cases reported.

Abely [203] describes a case in which what he calls the "syndrome of Stewart-Morel" occurred in a man of 51. He alleges that the diagnosis during life is difficult but that the condition most often occurs in women. Henschen chooses to call it "syndrome de Morgagni" or hyperostosis frontalis interna with virilism and adiposity. In the author's case the pituitary gland was enlarged, and a suspicion of syphilis was unconfirmed. Roentgen examination showed thickening of the internal plate of the frontal bone. In 2 of Morel's cases the cause of the condition was supposed to be chronic meningoencephalitis.

Estape's [204] case was that of a woman of 26 who gave a history of attacks of convulsions, nervousness and other psychiatric phenomena. The author made a diagnosis of "syndrome of Grieg-Morel" and describes his patient as being hyperthyroid, hyperhypophysial and hyperesthetic, with hyperparasympatheticotonia and a tendency to introversion, crises and convulsions preceded by an "aura abdominalis" and followed by a period of stupor and muscular asthenia. Roentgenograms showed bilateral internal hyperostosis of the frontal bone, no enlargement of the frontal sinuses and no change in the pituitary fossa. The patient was given psychotherapeutic attention and, as a placebo, intramuscular injections of 0.5 cc. of chemically pure oil of turpentine, which

202. Katsuta, T.: Ein Fall von zurückbleibenden Zähnen, Oto-rhino-laryng. **10**:730 (Aug.) 1937; abstracted, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **29**:215, 1937.

203. Abely, X., and Delmond, J.: Hyperostose frontale interne; démence, lipomatose symétrique, troubles infundibulaires, Ann. méd.-pyschol. (pt. 2) **95**: 225 (July) 1937.

204. Estape, J. M.: Sindromo osteopatico de Grieg-Morel, Rev. neurol. de Buenos Aires **1**:351 (March-April) 1937.

were later supplanted by injections of milk (twenty-four in all). The patient was restored mentally and went back to work.

Raso [205] collected 13 cases of internal frontal hyperostosis, mostly from autopsy material, and presents many photographs showing the typical increase in thickness of the internal table. The author discusses the various theories as to etiology and pathogenesis, which attribute the condition to (1) endocrine imbalance, (2) cerebral atrophy, (3) meningo-osseous adhesions, (4) altered calcium metabolism, (5) local Paget's disease, (6) inflammation and (7) circulatory disturbance. In the author's cases there was no evidence of pituitary disturbances or endocrine imbalance. In only 1 case was there adiposity, and in only 1, virilism. Histologically, when the process was active there was an appearance of extensive formation of fibrous tissue followed by the appearance of large numbers of osteoblasts. Later there is considerable absorption of the cellular elements, of the type associated with old age.

Reider [206] accounts for the internal hyperostosis in his case on a basis of pituitary dystrophy. His patient, a woman of 55, had symptoms of Alzheimer's disease, aphasia, mental deterioration, loss of weight, weakness and loss of memory. He does not believe that the hyperostosis could have caused sufficient pressure to account for the mental changes.

Donini [207] presents an extensive review of the subject and reports 3 cases. In the first case the condition was accompanied by psychic disturbances, in the second by "symptoms of schizothymia with disturbances of cenesthesis" and in the third by myoclonia and a state of profound dementia. In all 3 cases diagnosis was made during life. The first 2 patients are living; the third having died, a thorough study was made at autopsy. Histologic examination did not show myoclonic corpuscles anywhere in the brain. Roentgen examination of sections of the skull showed almost as clearly as the histologic sections the manner of increase in the thickness of the bone. The author believes the bony changes are due to osteosis and not osteitis and is in accord with Morel that the bone is much like that seen in cases of acromegaly. As to pathogenesis, he agrees with Morel that the basis of the syndrome is a disturbance in the diencephalohypophysial area, although positive proof is not available. He believes also that the syndrome may be influenced by alterations in the diploe and in the bones of the skull following chronic sinusitis. Bertolozzi calls this "reaction of adjacent parts." He

205. Raso, M.: Contributo allo studio dell'iperostosi frontali interna: Sindrome di Morgagni, Folia med. **23**:903 (Sept. 15) 1937.

206. Reider, N.: Alzheimer's Disease Associated with Hyperostosis Frontalis, Bull. Menninger Clin. **1**:123 (March) 1937.

207. Donini, F.: L'iperostosi frontali interna, Note e riv. di psichiat. **66**: 279 (July-Sept.) 1937.

describes a fourth case in which he believes the patient was in the initial stage of hyperostosis as a result of irritation from chronic sinusitis.

Wright [208] diagnosed his case as a true example of Paget's disease. In a woman of 20 a slowly growing mass developed over the left brow, which was observed for ten years. At the end of that period the eye was proptosed by a soft, smooth, fluctuating swelling just over the brow. Aspiration yielded a serosanguineous fluid, 250 cc. of which was removed. Roentgen examination showed a typical "nigger wool" skull. The mass occupied what might have been an expanded frontal sinus but presumably was not. The periosteum was part of the wall of the cyst. The proptosis was relieved by excision of the sac, but a deep scar resulted in the temporal quadrant of the orbit. No other bones were involved except those of the skull. Histologic examination of the excised tissue showed typical fibrocystic changes. No disturbance in the metabolism of calcium or phosphorus was demonstrated.

Yoshida [209] reports the case of a woman of 32 with gumma of the frontal bone. She complained of severe headaches, worse at night, and spontaneous pains in the right supraorbital region over a period of three months. There were a smooth swelling in this region, exophthalmos and ptosis. Roentgen examination showed a round defect of the bone in the lateral supraorbital area. Operation disclosed thick masses of pus; the bone and the periosteum were extensively destroyed, but there was no communication with the sinus. The symptoms disappeared under antisyphilitic treatment.

Pellegrini [210] reports 2 unusual cases of frontal sinusitis. The first was that of a man of 65 with a history of long-standing nasal discharge but no other symptoms. A small, soft swelling over the internal portion of the brow had been present since 1932. Aspiration revealed pus, and roentgen examination showed a defect in each wall of the sinus. Operation disclosed a large hole in the anterior wall of the frontal sinus, which was full of foul pus, and absorption of an area of the posterior wall exposing the dura, covered with granulations. The unusual feature of the case was the chronicity and absence of symptoms despite such extensive pathologic changes. The second case was that of a woman of 32 with postinfluenzal hemicrania. The symptoms and the roentgenograms pointed to involvement of the posterior sinuses. The ethmoid sinuses and the antrum were opened without affording relief. The frontal sinus was then opened and the duct enlarged, and the pains disappeared. This

208. Wright, R. E.: Fibrocystic Disease of the Frontal Bone (Paget's Osteitis), Brit. J. Ophth. **21**:364 (July) 1937.

209. Yoshida, I.: Ein Fall von Gumma des Os frontale, Oto-rhino-laryng. **10**:520 (May) 1937.

210. Pellegrini, G.: Aspetti clinici rari della sinusite frontale, Oto-rhino-laryng. ital. **7**:264 (June) 1937.

case was unusual in the absence of symptoms pointing to the frontal sinus. The pain was entirely in the parieto-occipital area.

Vernieuwe [211] describes a case of caseous sinusitis in which the patient was a young woman who in the course of three years had experienced several attacks of pain over the supraorbital area, with slight fever, edema, tenderness and exophthalmos. These attacks had subsided promptly on application of heat. A hard, smooth mass was seen in the middle meatus, biopsy of which revealed edema and plasmocytic infiltration. Removal of the mass with forceps and curets exposed large quantities of foul, thick, inspissated material filling the ethmoid sinuses and the antrum. In fact, the author states that nature had already accomplished a Caldwell-Luc operation so far as the nasoantral opening was concerned. Since the orbital edema did not subside, the antrum was opened sublabially and cleaned out. The nasofrontal duct was easily entered and the frontal sinus also relieved of large masses of the same foul material. Unexpectedly, however, a chill developed next day, and the patient died within a few days. Autopsy disclosed a large ruptured abscess of the frontal lobe and a dehiscence of the posterior wall of the sinus. The matrix of the abscess of the brain was invaded also by carcinoma, and there were no metastases. The author speculates on the etiology of caseation and suggests the association, as in his case, with atrophic rhinitis. He quotes Hajek on acute caseous frontal sinusitis, which is innocuous and is easily relieved by drainage.

Zubkus [212] reports a case in which a piece of pencil pierced the right eye and suppuration and a fistula in the medial orbital wall resulted after the removal of the eye. Roentgen examination showed the foreign body in the frontal sinus. Operation, however, disclosed the fact that the pencil had penetrated the frontal lobe, causing an abscess, from which 100 cc. of pus was evacuated. Recovery ensued. (The roentgenograms were taken only in the frontal plane. Had a lateral view been taken the correct diagnosis of the location of the foreign body would not have been missed.)

Ethmoid and Sphenoid Sinuses.—Ipolyi [213] had a case of orbital phlegmon in which the patient was a girl of 16 in whom the frontal sinus was absent and the ethmoid cells much eburnated. The antrum was infected and had to be opened and drained. The intranasal ethmoidectomy was difficult on account of the dense bone. The author attributes this condition to syphilis. The Wasserman reaction was strongly positive.

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211. Vernieuwe: La sinusite frontale caséeuse, Bruxelles-méd. **17**:726 (March 14) 1937; Rev. de laryng. **58**:529 (May) 1937.

212. Zubkus, J.: Ein ungewöhnlicher Fall von einem Fremdkörper im Lobus frontalis cerebri, Monatschr. f. Ohrenh. **71**:619 (May) 1937.

213. Ipolyi, F.: Akute Entzündung des eburnisierten Siebbeins infolge ererbter Syphilis, abstracted, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **29**:99, 1937.

Aydar [214] alleges that when vasomotor rhinitis is associated with an enlarged middle turbinate the posterior cells are blocked, which gives rise to swelling of their mucosa, discharge and other symptoms. His remedy is to exenterate the ethmoid sinuses. He reports good results but furnishes no detailed clinical reports.

In a case reported by Emiliani and Farjat [215] occipital headaches and pain in the eyes persisted after a Caldwell-Luc operation and exenteration of the ethmoid sinuses. Further roentgen studies revealed involvement of the sphenoid sinus, which at operation was found to contain pus and polyps. The authors prefer the Segura-Hirsch technic.

Hinnant [216] agrees with Hansel and others on the frequency of positive roentgen findings in cases of allergic conditions. He found this to be the case in 93 of 300 cases. He cautions against relying on one set of films and recommends repeated examinations with and without injection of iodized poppyseed oil. It is important to correlate the roentgen findings with the other clinical manifestations. As for surgical intervention, the author believes in deferring it until the allergic factors have been eliminated.

Fractures.—Coleman [217] presents a thorough analysis of fractures of the skull in relation to the sinuses and the mastoid. His observations are based on a study of 940 cases of trauma to the head at the Medical College of Virginia during 1935-1936. There were 216 fractures of the skull, of which 87 were basal. In the latter group there were 15 fractures involving the frontal sinuses; "six of these were associated with severe compound, depressed fracture of the frontal vault and operation was promptly done for disinfection, débridement and closure of the dura." Seven patients with linear fracture of the frontal sinus all recovered without operation. One patient with a linear fracture died of meningitis eleven days after admission. Autopsy disclosed fracture of the ethmoid and the petrous bone and laceration of the brain.

Pneumocephalus was a rather rare complication. It was found in 4 cases of this series. In 2 of them the air was in the subarachnoid space, and in a third the patient had air in a ventricle. The author states that "discovery of intradural air should lead to repeated x-ray examinations to determine whether the amount of air is increasing or diminishing. If it is increasing or is stationary for three or four days and cerebrospinal fluid is escaping, surgical intervention for closure of

214. Aydar, H. I.: Der nervöse Schnupfen und Ethmoiditis, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:580, 1937.

215. Emiliani, E. M., and Farjat, F. P.: Sinusitis esfenoidal, Rev. Asoc. méd. argent. **51**:58 (July 20) 1937.

216. Hinnant, I. M.: Nasal Allergy, Cleveland Clin. Quart. **4**:121 (April) 1937; West Virginia M. J. **33**:261 (June) 1937.

217. Coleman, C. C.: Fracture of the Skull Involving the Paranasal Sinuses and Mastoids, J. A. M. A. **109**:1613 (Nov. 13) 1937.

the dural laceration is indicated." If no leak is present and the intracranial tension is not raised, air may be released by puncture and the space filled with Ringer's solution. The anterior ethmoid and the frontal sinus may be exposed for repair of dural laceration or relief of pneumocephalus "through a small frontal flap, with elevation of the dura from the floor of the fossa, access thus being given both to the inner wall of the frontal sinus and to the ethmoid on the side of the operation."

The author discusses various types of fracture into the frontal sinus and the danger of meningitis, which depends as much on the state of the sinus (bacteria) as on the extent of the fracture. If the general condition permits, patients with compound fracture, especially when the fracture is associated with dural laceration, should be operated on to cleanse the wound, remove fragments, elevate the bones and close the dura. Linear fractures radiating from the vault into the frontal sinus are still the subject of considerable difference of opinion. Most of these fractures pass through the sinus to the floor of the anterior fossa and may lacerate the dura. There is no way of determining whether this has occurred. Absence of infection or leakage in cases of linear fracture of the inner wall of the sinus has impelled the author to adopt conservative treatment, frequently with good results, despite fracture of the inner wall of the sinus.

Cairns,[218] like Coleman, has gone into the subject of fractures extensively and presents an exhaustive treatise with a number of illustrative cases, roentgenograms and other material. He admits that there is a difference of opinion as to the advisability of early operation in cases of fracture of the skull involving the frontal sinus. The difficulty often lies in the matter of time, place and availability of an expert surgeon as well as in such factors as shock and injuries elsewhere. Rhinorrhea usually means involvement of the cribriform plate, where the dura tears easily. The anterior pole of the frontal lobe usually blocks the gap if the fracture is through the posterior wall of the sinus, and the fluid will not escape so easily at this point. The author feels that greater accuracy in roentgenologic diagnosis is needed, and he is considering the value of tomography in this connection. Operation is indicated if a tear in the dura can be demonstrated or if the fracture extends into an infected sinus. When symptoms develop some time after the injury, careful examination is needed to determine the location of the injury. Rhinorrhea and aerocele are significant. The latter may be subdural or intracerebral. In 1 case the differential diagnosis was made by the fact that fissures as curved lines were seen running into the area of the aerocele, indicating that the latter was intracerebral. The author says: "Fissures cannot be flattened out, partly because of the resistance of

218. Cairns, H.: Injuries of the Frontal and Ethmoidal Sinuses with Special Reference to Cerebrospinal Rhinorrhoea and Aeroceles, J. Laryng. & Otol. **52**: 589 (Sept.) 1937.

the pial membrane, but chiefly because of the blood vessels which they contain." Delayed complications when palliative treatment has been followed seem to convince the author of the importance of early operation. "The barrier against infection could be strengthened either by suture of the dura or repair of the dura by means of a graft of fascia lata." He states that exposure of the cribriform plate is not difficult, and the indication in these cases as well as cases of spontaneous rhinorrhea is to close the laceration as mentioned. Thirteen cases are described in detail with full comment, and the review constitutes an excellent exposé of the entire subject.

Nathanson [219] states that fractures of the skull involving the sinuses are much less frequent than those affecting the auditory apparatus. He refers to Voss's report of 121 cases, in only 17 of which the sinuses were affected. The author reports 10 cases, in 3 of which the end was fatal. As a rule, when the skin is broken the condition is less dangerous than when it is intact. In the latter the swelling of the mucosa and the accumulation of blood clots prevent drainage, a condition which favors infection. Early intervention is advised, for the release of blood, removal of bone splinters and inspection of the dura. The author favors intranasal drainage, although in some cases it may be advisable to drain externally.

Gottesberge [220] reports 2 cases of fracture with late complications. In the first, a boy of 6 years was well for three weeks after a fracture of the skull and was discharged from the hospital. Eleven months later the child was readmitted with meningitis. Operation showed that infection had entered through an open fracture which ran through the frontal bone into the ethmoid region. In the second case, fifteen years after a fracture of the skull meningitis developed. Autopsy disclosed a defect in the posterior wall of the frontal sinus. The sinus itself was filled with old scarred tissue, which obliterated its lumen. In neither case did the fracture involve the cribriform plate. The author noted a characteristic swelling and redness of the upper lid in both cases.

Omer [221] tells of an unusual case of fracture. He states that in the mountainous districts of Albania, where physicians are few and far between, the inhabitants often resort to crude measures for relief. The case in point is that of a man of 30 who had a wisdom tooth pulled by a layman, who used a horse shoer's forceps and tore out the entire upper jaw. Examination revealed no evidence of syphilis or disease of bone. The wound healed, and the man was later fitted with a prosthesis.

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219. Nathanson, G.: Traitement des fractures de la base du crane interessant les cavites des fosses nasales, Acta oto-laryng. **25**:431, 1937.

220. Gottesberge, M. A.: Ueber spätmeningitis nach Frakturen der vorderen Schädelgrube, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **142**:299, 1937.

221. Omer, B.: Totale Abrissfraktur der oberkieferhälfte mit Eröffnung der Nebenhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **40**:641, 1937.

News and Comment

CASSELBERRY PRIZE FUND

The sum of $500 has accrued from the Casselberry Fund, for encouraging advancement in the art and science of laryngology and rhinology, and is now available, in part or as a whole, for a prize award or decoration or to defray the expense of original investigation or research in the domains mentioned. Theses or reports of work done must be in the hands of the secretary, Dr. James A. Babbitt, 1912 Spruce Street, Philadelphia, before February 1 of any given year. Any further information desired will be gladly furnished by the secretary.

Abstracts from Current Literature

Ear

EIGHTH NERVE HIGH TONE DEAFNESS FROM NUTRITIONAL STANDPOINT. G. SELFRIDGE, Ann. Otol., Rhin. & Laryng. **46**:93 (March) 1937.

Selfridge declares that the work of Peters, of Oxford, proves conclusively that some factor in the vitamin B complex is necessary for perfect biologic equilibrium. Thus, the oxidation-reduction system is necessary in order to prevent the accumulation of lactic acid in certain parts of the brain. The observation of definite demyelination in both branches of the eighth nerve in a series of rats and chicks placed on a diet deficient in the factors of the vitamin B complex, B_1B_2 and especially the filtrate factors B_6B_7 or K_1K_2, as shown in Covell's histopathologic studies, warrants the assertion that lack of sufficient vitamin B in the human diet is the principal cause of degeneration in the eighth nerve. The clinical use of B_1 parenterally, B_1B_2 absorbate and particularly the rice bran B complex appears to be the cause of the improved hearing noted in the audiograms of clinical patients. Administration of large doses of carotene (30,000 units daily) over a period of months has caused no further change in hearing as demonstrated by the audiograms. Perhaps if the administration of carotene or vitamin A was carried on over a longer period, under control of the photometer, further changes might be noted. The use of thyroid, except possibly in rare cases, does not influence the changes in the nerve. Its effect probably is to help in the general metabolic processes. The lowered basal rate in many instances is related to nutritional deficiencies. The white edema observed by Cody in his animals kept on a diet deficient in vitamin B and seen in human beings with the pharyngoscope appears to be conclusive evidence of vitamin B deficiency. No interpretation can be made regarding the association of high tone deafness with the linear type of body build.

EDITOR'S ABSTRACT. [ARCH. NEUROL. & PSYCHIAT.]

THREE CASES OF MASTOID ASYMMETRY. E. WATSON-WILLIAMS, Proc. Roy. Soc. Med. **30**:423 (Feb.) 1937.

Three cases are reported in which one mastoid was of normal cellular development and the other showed no cells roentgenologically. There is some speculation regarding the cause of the lack of cells, the author leaning toward the theory that the mastoid cells did not develop rather than that they were destroyed early in life.

CAMPBELL, Philadelphia.

CHRONIC LABYRINTHITIS: FRACTURE OF MASTOID PROCESS INVOLVING FACIAL CANAL. E. WATSON-WILLIAMS, Proc. Roy. Soc. Med. **30**:424 (Feb.) 1937.

A case in which there were long-standing symptoms of acute labyrinthitis and superimposed injury to the head is reported in detail. At operation a transverse fracture across the mastoid process running to the facial ridge was found. The malleus and the incus were found to be ankylosed and the vestibule completely solid. The labyrinthine symptoms were relieved after the operation, and the facial weakness disappeared.

CAMPBELL, Philadelphia.

SOME OBSERVATIONS ON THE FUNCTION OF THE LABYRINTH. I. A. TUMARKIN, Proc. Roy. Soc. Med. **30**:599 (March) 1937.

The author first discusses the following sources of error in the rotation test for the function of the labyrinth: (1) excessive stimulus; (2) visual influences; (3) bias of the examiner, and (4) confusion of postrotatory nystagmus with (*a*) perrotatory nystagmus and (*b*) secondary nystagmus.

To correct such errors in the ordinary rotation test the author uses an instrument which he has modified from the one designed by Professor Dodge, of Yale University. A full description of this instrument is given, with drawings and charts.

In the latter part of the article the author discusses Ménière's syndrome, showing that patients with that disorder may present two entirely different types of attack, one in which the symptoms are referable to the semicircular canals and another which the author calls the "otolithic castastrophe." He speculates on the functions of the otoliths.

CAMPBELL, Philadelphia.

PREVENTION AND TREATMENT OF INFECTIONS OF THE MIDDLE EAR OF INFLUENZAL ORIGIN. M. ROSENBLATT, G. LÉVY and L. CHEYVACHMANN, Arch. de méd. d. enf. **40**:265 (May) 1937.

For more than two centuries it has been recognized that the grippal attack is a menace to the middle ear. In a review of the epidemic of grip of 1932-1933 in Moscow, Russia, it was found that 70 per cent of the children coming to autopsy because of this disease showed involvement of the structures of the middle ear; the incidence during life could not be recorded so accurately, but various authorities reported from 4.87 (Courtwiste and Cherere) to 73 per cent (Wesselle). In many cases suppurative otitis undoubtedly develops during the later stages of acute infections and can be demonstrated only post mortem. Of a series of 372 cases followed by the writers, 218 occurred in boys and 154 in girls, the ages ranging from 1 month to 8 years, which conforms with the experience of American clinicians so far as the relatively high percentage of cases in males is concerned. Among these 372 cases there were 75 invasions of the middle ear, or 20 per cent of the total. The highest percentage was found in the group from 1 to 3 years of age, the results differing in this respect from the observations of Aschoff and others, who found this complication most frequently in infants up to 6 months of age.

In the authors' series of 75 auricular involvements, 26 were unilateral and 49 bilateral, and practically all of them were associated with some other acute inflammatory disturbance of the upper airways. Precipitation tests showed a rate of from 60 to 70 mm. per hour when bronchopneumonia was present. Children who had suffered previous attacks of otitis were singularly resistant to infection during influenza, which led the authors to feel that an allergic reaction of the mucous membranes should be considered. Paracentesis was employed freely, and accurate data collected on the character of the bacterial flora. It was found that the breast fed infant reacted much more favorably than the infant artificially fed, and that associated rickets prolonged the course of the disease. Only 5 children were subjected to exploration of the mastoid, while in a previous series of 32, 28 children were operated on. Cooperation of the otologist and the pediatrician for joint observation of these infections is urged.

AMESSE, Denver. [AM. J. DIS. CHILD.]

INTRACRANIAL SECTION OF AUDITORY NERVE IN TREATING AURICULAR VERTIGO. M. OMBRÉDANNE, Mém. Acad. de chir. **63**:379 (March 17) 1937.

Ombrédanne utilizes Dandy's method in a modified form: partial section of the auditory nerve, which suppresses vertigo and pain but saves the sense of hearing. In all of 19 cases of simple Ménière's syndrome in which operation was performed, the result was successful. Of 17 patients with atypical Ménière's syndrome, 14 were cured, 2 died and in 1 the symptoms persisted. Some of these patients were very vertiginous, were deaf in one ear and had intolerable tinnitus. The 2 who died had chronic otorrhea and had previously had several operations. The patient is prepared with sedatives a few days before the operation. He is made to lie on his abdomen, with his head beyond the border of the table on a special

support. With the area under local anesthesia, the incision is started about 1½ inches (3.8 cm.) below the external occipital protuberance near the median line, and is continued obliquely toward the posterosuperior angle of the mastoid and straight down to the inner side of its apex. When the zone is exposed, care must be taken of the mastoid vein and of the suboccipital venous plexuses. The trephine opening is made with a large drill in the horizontal part of the occipital bone, about an inch (2.5 cm.) from the posterior border of the mastoid and from the upper curved line of the occipital bone. The orifice is then rapidly enlarged by means of semicircular forceps, but cautiously, lest the mastoid cells be opened. With the aid of a small hook, the dura is drawn back from the cerebellum as much as possible, and a crossed incision resulting in four flaps is made. The posteroinferior aspect of the cerebellum is then raised. The arachnoid over the posterior cistern is incised. A retractor is then inserted between the petrous bone and the cerebellum, and the latter is pushed slowly inward while the retractor is gradually forced deeper. Evacuation through suction of the pontocerebellar cistern gives access to the auditory nerve. The two branches of the auditory nerve are separated, and the thicker, the vestibular, nerve is cut. Its two ends recede immediately, leaving the cochlear nerve intact. The dura is then carefully sutured with fine catgut or silk, and a drain of horsehair is left between it and the flap of skin for from twenty-four to forty-eight hours. Postoperatively there are violent nystagmus, which disappears in from ten to twenty days, and vomiting and vertigo, which vanish soon. The same may be said of the occipital headache, elevation of temperature (100.4 F.) and diplopia. The original pain, dizziness and tinnitus however, which are strong at the time of the operation, do not return.

EDITOR'S ABSTRACT. [ARCH. NEUROL. & PSYCHIAT.]

Pharynx

THE EFFECT OF DEEP X-RAY THERAPY IN A CASE OF CARCINOMA OF THE HYPOPHARYNX AND CERVICAL GLANDS. W. J. MCNALLY, Proc. Roy. Soc. Med. **30**:918 (May) 1937.

A case is reported in which carcinoma of the left piriform sinus involving the aryepiglottic fold and the lateral pharyngeal wall caused such difficulty in swallowing and breathing that tracheotomy was necessary. The lesion was considered inoperable; so extensive high voltage roentgen therapy was instituted. About one year later extensive malignant growths developed in both lungs, and the patient soon died of pneumonia. At autopsy there was no evidence that there had ever been growth in or about the pharynx or the larynx, which emphasized the value of thorough roentgen therapy in cases of inoperable carcinoma.

CAMPBELL, Philadelphia.

CARCINOMA OF TONGUE, FOLLOWED BY CYSTIC ADENOMA OF THYROID. NORMAN PATTERSON, Proc. Roy. Soc. Med. **30**:1393 (Sept.) 1937.

Patterson reports a case in which cystic adenoma of the thyroid followed by about five years the diathermic excision of a carcinoma of the base of the tongue. The thyroid was removed and found to be nonmalignant.

CAMPBELL, Philadelphia.

BACTEREMIA FOLLOWING ADENOIDECTOMY AND TONSILLECTOMY. J. F. HULK, Nederl. tijdschr. v. geneesk. **81**:2202 (May 15) 1937.

Influenced by the studies of Okell and Elliott (*Lancet* **2**:836, 1936) on bacteremia in relation to extractions of teeth, Hulk has carried out a similar investigation in 220 cases of adenotomotonsillectomy. In 24 of 100 children bacteremia was demonstrated immediately after operation (while just before tonsillectomy

only 3 positive cultures, which are supposed to have been due to focal infection, were obtained). In 39 of 120 other children bacteremia was established immediately after adenotomotonsillectomy, but four hours later a positive blood culture could be obtained from only 3 of these patients. Cultures of blood usually showed streptococci, which mostly belonged to the viridans or to the hemolytic group; pneumococci were found less often; staphylococci, only once. The literature, the clearing mechansm in bacteremia and the possibility of sequelae from bacteremia following adenoidectomy and tonsillectomy are discussed.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

Larynx

LARYNGEAL SYMPTOMS IN CHILDREN. E. J. PATTERSON, Pennsylvania M. J. **40**:257 (Jan.) 1937.

Anatomic differences between the larynx of the child and that of the adult account for the differences in laryngeal symptoms. These alterations are reviewed. The symptoms of congenital and acquired conditions are listed. The author stresses the danger of inferential diagnosis of laryngeal disease in children. Differential diagnosis by laryngoscopy is indicated in all cases. The larynx is easily examined by the direct method in any child, even a newborn one. Tracheotomy, when indicated, is preferred to intubation.

LOGUE, Williamsport, Pa. [AM. J. DIS. CHILD.]

LARYNGECTOMY FOR CARCINOMA OF LARYNX, WITH DEVELOPMENT OF SECONDARY GLAND NEARLY FIVE YEARS AFTER ORIGINAL OPERATION. NORMAN PATTERSON, Proc. Roy. Soc. Med. **30**:1393 (Sept.) 1937.

The patient was apparently free from any signs of recurrence following laryngectomy for about five years, when a lump was noticed on the neck. This was removed and found to be a secondary carcinoma replacing a lymphatic gland.

CAMPBELL, Philadelphia.

EVIDENCE OF COMPARATIVE ANATOMY ON STRUCTURE OF HUMAN LARYNX. V. E. NEGUS, Proc. Roy. Soc. Med. **30**:1394 (Sept.) 1937.

The anatomic and the physiologic picture of the larynx of man are discussed in considerable detail, and comparisons of some of these structures with analogous ones of various animals are made. The following conclusions are reached:

1. "For protection of the lungs the larynx of man is efficient."
2. "For combined respiration and deglutition, efficiency is slight in the adult but better in the infant."
3. "Respiration is not served to the degree of efficiency seen in many animals."
4. Phonation is well served by the long and flexible vocal cords of man.
5. The larynx of man is an extremely versatile and efficient organ.

CAMPBELL, Philadelphia.

NEW PHOTOLARYNGOSCOPE. G. SAUER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:187, 1936.

Sauer describes an instrument which makes possible photographic records of the condition of the larynx. The instrument consists of a laryngoscope and a mirror reflex camera. The author describes the technic and reproduces several photographs that were made with the photolaryngoscope. EDITOR'S ABSTRACT.

Nose

CHRONIC SINUSITIS IN CHILDREN. H. B. MARKS, New England J. Med. **216**:604 (April 8) 1937.

The patient with chronic sinusitis presents certain typical signs. Perhaps the most constant one is a purulent exudate on the posterior wall of the nasopharynx. The postnasal drip is most often seen in the morning, before the patient rises from a horizontal to a vertical position, but is frequently seen throughout the day. This postnasal discharge, dropping down the trachea during sleep, is responsible for the various types of pulmonary lesions that are associated with chronic sinusitis. Bullen studied 400 cases of chronic sinal disease of at least one year's duration and found that 25 per cent of the patients had chronic nontuberculous pulmonary disease in some form; 10.5 per cent had chronic bronchitis, and 8 per cent had bronchiectasis. The postnasal drip is responsible to a certain extent for the loss of appetite, as it is continually being swallowed.

Because of the lymphatic drainage of the sinuses, it is common to find enlargement of the posterior cervical lymph nodes along the posterior border of the sternocleidomastoid muscle. The anterior nares are frequently filled with an encrusting exudate. There is a characteristic metallic odor to the breath. Frequently there are triangular areas of edema beneath the outer third of the lower eyelid, over the malar prominence.

As regards treatment, at the Boston Floating Hospital the procedure has been to make an opening into the antrum, below the inferior turbinate, with a rasp. Postoperatively, irrigations of the antrums are performed daily until the returns are free from purulent material. Any treatment of chronic sinusitis which is at once complete and effective includes a program that provides for an adequate diet and avoidance of overfatigue. GENGENBACH, Denver. [AM. J. DIS. CHILD.]

SINOGRAPHY: A METHOD OF RADIOGRAPHY IN THE DIAGNOSIS OF SINUS THROMBOSIS. P. FRENCKNER, Proc. Roy. Soc. Med. **30**:413 (Feb.) 1937.

Sinography is a method of demonstrating obstructions in the circulation of the blood in the dural sinuses or the jugular vein by roentgen examination after injection of a radiopaque substance into the dural sinuses of the skull. It is applicable chiefly in cases of bilateral otitis in which there is fairly positive evidence of sinus thrombosis but one is not sure in which of the sigmoid sinuses it is situated. The method consists in injecting a radiopaque substance into the longitudinal sinus and photographing the area during the injection at the moment when the sinuses are filled. The opening through the skull is made by incision and drill in the midline, 5 cm. above the external occipital protuberance. The sinus is punctured by a needle and a 35 per cent solution of skiodan injected. Three cases in which the procedure was used are reported. It was found that anatomic anomalies involving the venous sinuses, particularly the torcular Herophili, may lead to an indefinite or a mistaken diagnosis. CAMPBELL, Philadelphia.

Miscellaneous

MECHANISM OF HEADACHE. T. FAY, Arch. Neurol. & Psychiat. **37**:471 (Feb.) 1937.

Through the application of faradic stimulation, traction, irritation and heat to the structures, within the cranial cavity, with the patient under light or local anesthesia, Fay observed that a sensation of pain similar to localized headache can be produced only when the branches of the meningeal artery are directly involved. Referred pain similar to headache can be elicited by stimulation of the superior sinus from a point approximately underlying the hair line of the forehead to the torcular Herophili, the two lateral and the two sigmoid sinuses. Great pain was experienced from the traction or stimulation of the branches of the venous

supply, the tentorium, the inferior straight sinuses and the cavernous sinus and, on one occasion, by stimulation of the right choroid plexus.

Fay noted the following with regard to pain referred to the eyes: Stimulation of the arterial tree near the branches of the circle of Willis produced pain referred deep into the eyes and the forehead. Stimulation of the superior sinus produced diffuse regional pain, referred to a point deep in the eyes, especially as the point of stimulation approached the torcular Herophili. Stimulation of the tentorial veins and lateral sinuses produced pain referred to the occipital area and deep behind the eyes. Compression of the jugular vein of the neck, with pressure in the lateral sinus and the posterior portion of the superior sinus, produced occipital headache referred deep into the eyes, when the vascular engorgement reached a point of actual gross tumescence of the dural sinuses.

The author believes that his observations show that fibers for pain situated on the large arterial branches to the cranial structures leave the skull, the face and the head via their vascular structures to descend into the upper part of the thorax by various routes and into the spinal cord through the posterior route mechanism between the seventh cervical and the fifth thoracic segment of the cord.

In summary, Fay reduces the pathogenesis of headache to the common denominator of pain due to stretch of the cerebral vascular tree when extremes of hydration or dehydration are such as to alter grossly the volume relationships of the cranial cavity and bring about physical stretch on the sheath of the large arteries and venous sinuses. He suggests treating by hydration or dehydration, whichever counteracts the cause of the symptom in the particular instance. He gives his criteria for deciding whether a headache is due to hydration or to dehydration.

R. Irvine, Los Angeles. [Arch. Ophth.]

Para-Aminobenzenesulfonamide and Its Derivatives. P. H. Long and E. A. Bliss, Arch. Surg. **34**:351 (Feb.) 1937.

Long and Bliss describe briefly the action of the compounds which were tested in the clinical use of sulfanilamide (para-aminobenzenesulfonamide) and its derivatives in the treatment of human beings with infections due to hemolytic streptococci. Experimental observations suggest that these compounds act by inhibiting the growth of beta hemolytic streptococci and that they injure these organisms in such a way as to permit them to be phagocytosed by the white blood cells. Several different preparations were used for a variety of infections produced by beta hemolytic streptococci. The method of administration and the dosage of the drug for the various types of infection are described. It is concluded that this drug and its derivatives have a specific chemotherapeutic effect in infections produced by beta hemolytic streptococci.

Kaiser, Rochester, N. Y. [Am. J. Dis. Child.]

Acute Osteomyelitis in Childhood. H. E. Conwell and J. D. Sherrill, South. M. J. **30**:171 (Feb.) 1937.

Acute osteomyelitis in older children differs from that in infants under 2 years. The latter is due to Streptococcus haemolyticus, and if the child survives the acute attack the recovery is rapid and complete; the former is generally due to Staphylococcus aureus and if not diagnosed and treated in its early stage becomes chronic and persists with frequent recurrences, often throughout life.

The danger lies in delay of diagnosis and treatment, which allows destructive inflammation of bone and results in permanent disability and even death.

The disease rarely occurs after the epiphysis is completely fused with the shaft of the bone.

Infection is carried by the blood and is contracted through the mouth—by way of the tonsils, the sinuses or the middle ear—and through cutaneous surfaces, as impetigo, boils or the like.

The patient, apparently well, contracts sore throat or has a local infection of the skin and probably has received an injury sufficient to wrench or twist one of

the epiphyses, causing minute hemorrhage and thus forming a good culture medium for micro-organisms. In a few days pain and tenderness develop in the joint, and there is fever; the pulse is rapid and the tongue dry, and there is definite leukocytosis, with the picture of septicemia. Early roentgenograms show no abnormality. Blood transfusions are often indicated—sometimes even before operation. Treatment with roentgen rays of high voltage, while of no benefit in osseous involvement, is successful where there is a large area of slowly healing granulation tissue.

SCHLUTZ, Chicago [AM. J. DIS. CHILD.]

LARGE ENCAPSULATED ABSCESS OF THE RIGHT TEMPORAL LOBE FOLLOWING LATENT OTITIS IN A CHILD: EXCISION IN ONE PIECE WITHOUT DRAINAGE; CURE. E. LESNÉ, M. DAVID, C. LAUNAY and H. ASKENASY, Bull. Soc. de pédiat. de Paris **34**:20 (Jan.) 1936.

A girl 11 years old had earache, more marked on the right side, and impaired hearing two months prior to her admission to a neurosurgical ward. About a week after the onset of the illness, after the symptoms in the ear had subsided without suppuration, she began to complain of frontal headache. She was thought to have meningitis. The spinal fluid was turbid and contained 150 cells per cubic millimeter, and there was bilateral papilledema. The patient's condition improved, and these signs practically disappeared in five weeks. She then became steadily worse, and a tumor of the brain was suspected. A ventriculogram showed evidence of an expanding dense area pushing the right frontal ventricular horn, which was flattened and deformed, over to the left of the midline, and the third ventricle was on the left of the midline. In the lateral view the right temporal horn was not outlined, and the sutures were widened. At operation the right temporal lobe was edematous, and when the tip was incised a grayish red capsule of an abscess was encountered 1 cm. beneath the surface. The abscess was excised en masse, and the head was closed without drainage. The specimen removed weighed 110 Gm. It contained numerous organisms, most of which were streptococci and staphylococci. The child recovered. When examined five months later, she was perfectly well except for slight paresis of the center of the left side of the face. The period of five weeks during which improvement was noted may probably be explained by the gradual separation of the sutures, which acted as a decompressor. It is recommended that one should wait for from fifteen to twenty days before operating on otogenic abscesses that the encapsulation may occur, and that then the abscess should be removed with its surrounding capsule, without drainage; in the meantime, decompression by lifting up a bony flap and aspirating through the dura without incising the dura may be performed, if necessary.

BENJAMIN, Montreal, Canada. [AM. J. DIS. CHILD.]

OXYGEN IN THE TREATMENT OF NOMA OF THE MOUTH IN CHILDREN. M. SALMON and A. JOUVE, Bull. Soc. de pédiat. de Paris **34**:124 (Feb.) 1936.

Six cases of noma of the mouth and pharynx observed in fifteen months are reported. In 4 the condition occurred after typhoid fever. Of the 6 patients, 5 recovered. In addition to various treatments, which included removal of gangrenous tissue with the cautery, a stream of oxygen was applied through tubes to the ulcerated surfaces for five or ten minutes every hour or two, and it is felt that this was a factor in achieving a higher than usual percentage of cures.

BENJAMIN, Montreal, Canada. [AM. J. DIS. CHILD.]

STUTTERING: ITS NEUROPSYCHIATRIC ASPECT. F. GREWEL, Psychiat. en neurol. bl. **41**:16 (Jan.-Feb.) 1937.

The stuttering mechanism is analyzed from the point of view of the constitutional coordinative and neurotic factors. From a review of the literature Grewel

concludes that a constitutional tendency to stuttering can be traced in some cases, although it seems not to play a decisive role. Coordination of speech apparently is of greater importance. Some of the phenomena well known in organic nervous diseases, such as perseveration, reiteration, logoklony, echolalia and palilalia, show a marked resemblance to stuttering. Considerable difficulty in any analysis arises from incomplete definition of the word "stuttering" as well as of many of the aforementioned organic defects in speech. The closest organic parallel to the phenomenon of stuttering is seen in palilalia. The stuttering factor in palilalia is considered to be cortical. The striatal localization of stuttering is rejected. One of the factors involved in the development of stuttering, especially between the fourth and the sixth year, is found in insufficient automatization of speech. The motor component of stuttering is assumed to be analogous to that of subcortical motor aphasia.

These considerations point to the presence of a psychic mechanism. One may think in this connection of the babble of children or of the iteration of primitive languages. Following this trend of thought, one may conceive of stuttering as an emotionally conditioned regression to a primitive mechanism of speech. Stocker pointed out that stuttering is analogous to ideomotor parapraxia. On the other hand, the stutterer, besides his leading symptom, shows a number of signs which are common in neurotic persons, such as movements of torsion of the head, fixation of one point, flushing, blowing out the cheeks, rubbing the hands and folie du doute, uncertainty, timidity and lack of self confidence. The significance of the neurotic phenomena of stuttering is seen in the wish not to pronounce certain letters. Here the mechanism which forms the basis for the incoordination of speech interferes.

Since stuttering is not a nosologic unit, treatment must be individualized. The importance of general psychic therapy is emphasized. Change of milieu, instruction of parents and building of character are of greater importance than exercise. The personality of the teacher is important. In the presence of deeper conflicts a psychiatrist is necessary.

LEWY, Philadelphia. [ARCH. NEUROL. & PSYCHIAT.]

THE SIGNIFICANCE OF PATHOLOGIC VARIATIONS IN TWINS IN THE STUDY OF SPEECH DEFECTS. M. SEEMANN, Časop. lék. česk. **74**:1238 (Nov. 8) 1935.

In a phoniatric study of a large group of school children, 33 sets of twins, including 22 monosexual and 11 duosexual sets, were studied intensively. There were 11 single ovum sets of twins, of whom 8 had delayed speech, 5 speaking at from 2½ to 3 years of age and 3 after 3 years. Six of the sets with delayed speech were boys. With more than half of these single ovum sets whose speech was delayed there was a history of delayed speech in the father. Of the 22 sets of nonidentical twins, 8 had delayed speech, and in 2 sets only a single one of twins was delayed in speech. In no case of identical twins was there any difference in the time of the individual onset of speech. Stuttering was found in only a single twin in each of 4 sets of nonidentical twins, and in no case was there a psychic involvement of the other twin. One case was recorded in which the mother stuttered in childhood. In one set of identical male twins both boys stuttered. In this instance the paternal grandmother and 3 paternal uncles stuttered. The author gives a short review of the literature and a citation of case reports.

STULIK, Chicago. [AM. J. DIS. CHILD.]

RESISTANCE OF CHILDREN TO REPEATED NOSOCOMIAL INFECTIONS OF THE UPPER PART OF THE RESPIRATORY TRACT. C. GYLLENSWÄRD, Acta pædiat. **19**:153, 1936.

In a children's home in Stockholm, Sweden, systematic records were kept of the incidence of nosocomial respiratory infections in children between 1 and 7 years of age; the observations extended over a five year period and embraced 638

children, who spent a total of 59,771 days in the institution. The results were examined statistically from the following points of view: age, sex, sensitivity to tuberculin, length of stay in the home, number of nosocomial infections, types of infection, incidence of infection, time of onset of infection, duration of illness and complications. The infections were divided into two classes on the basis of severity, namely, those which were accompanied by a temperature of as high as 37.5 C. (1,114 cases) and those in which the temperature rose to 38 C. (872 cases).

The first wave of infections of the respiratory tract affected children who were previously healthy on either the third or the tenth day after admission; the infections of the third day were mild; those of the tenth day, severe. Later another wave occurred. The infections which occurred during the fifth week after admission were relatively mild, while those which occurred during the sixth week were somewhat more severe. A third wave usually appeared six weeks after the second, and the infections showed different degrees of severity. In the fourth wave, those infections which appeared six weeks after the preceding one were severe, while those which appeared at seven weeks were milder. If the children remained in the hospital long enough, further outbreaks of infection occurred at similar intervals; however, the frequency of severe infections declined as did the number of children affected, and the duration of illness tended to decrease. These observations suggest that recurrent infections of the respiratory tract enhance the immunity of those who suffer from them; this conclusion is strengthened by the fact that the younger children were infected more frequently than the older ones and that their illnesses were more severe. No sexual differences were observed.

McCUNE, New York. [AM. J. DIS. CHILD.]

ARTIFICIAL PNEUMOTHORAX THROUGH A PIERCING WOUND OF THE BRONCHUS CAUSED BY A TACK. C. E. BENJAMINS, Nederl. tijdschr. v. geneesk. **80**:4712 (Oct. 17) 1936.

An upholsterer's tack was aspirated into the right bronchus by a 5 year old girl. After three months roentgenograms revealed that the inferior and the middle lobe of the right lung had become atelectatic and that the point of the tack had probably pierced the bronchial wall. The tack was removed by inferior bronchoscopy, and immediately after its removal cutaneous emphysema announced the foreseen calamity of mediastinal emphysema. Preparations had been made for artificial pneumothorax, which was immediately carried out. This excluded the right lung, and air was thus prevented from penetrating the mediastinum. The child recovered. Half a year after the operation roentgenographic examination revealed shriveling of the entire inferior lobe of the right lung, together with bronchiectasis. The child was well, however, and had gained considerable weight.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

Society Transactions

AMERICAN LARYNGOLOGICAL ASSOCIATION

JOHN F. BARNHILL, M.D., *President*

Sixtieth Annual Congress, Atlantic City, N. J., May 2-3-4, 1938

CHARLES J. IMPERATORI, M.D., *Editor of Abstracts*

PRESIDENT'S ADDRESS. DR. JOHN F. BARNHILL, Miami, Beach, Fla.

For the sixtieth time the president of the American Laryngological Association says "Thank you for the honor." The period from Elsberg to Chamberlain covers the entire history of laryngology. County seats have more practicing laryngologists today than the largest city when Elsberg held the gavel. There are now thousands of otolaryngologists in Canada and the United States, collectively. This society, the oldest organization, limits its membership to one hundred. It has a high standard. "Too high?" some have asked. Is it possible that out of all the thousands of otolaryngologists, there are but one hundred qualified to meet the standard set by this organization? Is it too exclusive? Does the requirement dampen the ambition of many worthy, high class laryngologists? Is this exclusiveness that is practiced good for the American Laryngological Association itself? Some think it is not.

The question of the social attitude should be discussed. Are new members made to feel sufficiently at home? Are the sick, the semiretired and the retired members sufficiently remembered and adequately honored? Expressions of good will from the society as a whole, or from individual members, are more helpful than drugs or appliances. The situation is open to improvement. Are the genuine workers sufficiently supported and honored? A word of encouragement from this society puts courage into the investigator that may enable him to go on to success.

Should the association not have a section in the special journals devoted to a bulletin that will keep all members promptly posted as to the activities of its members? A member may be ill for a long time, may die or may be highly honored by some college or society without the fellows knowing it, unless informed by some such bulletin.

Are the wives and daughters of fellows given sufficient opportunity for enjoyment at the annual meetings? Should they not be organized among themselves for the purpose of getting the most possible out of these occasions? Let the women make up their own programs, for they know best their wants. Let the fellows provide the sinews of war, but grant the women the privilege of controlling their own affairs.

Questions of the value of climate have not been sufficiently discussed. Books on the subject need revision. The American Laryngological Association, because of age and leadership, should do this. The question is delicate and will require unprejudiced writers, good observers, who have lived long enough in any locality to have witnessed both the faults and the benefits incident to a given region. To carry out this work properly will require much time and considerable expense. Costs may be met by presubscriptions to a book on this subject, which, if well prepared, will be among the most valuable in any physician's library. The effort will, no doubt, require strenuous, unselfish labor on lines differing from those necessary under the presiding of Elsberg in 1879.

PLASTIC REPAIR AFTER REMOVAL OF EXTENSIVE MALIGNANT TUMORS OF THE ANTRUM. DR. FREDERICK A. FIGI, Rochester, Minn.

This article was published in full in the July issue of the ARCHIVES, page 29.

DISCUSSION

DR. THOMAS E. CARMODY, Denver: Recently, a patient suffering from oversecretion of saliva was treated by roentgen rays because it was felt that irradiation would stop the flow. The treatment has not produced entirely satisfactory results up to the present. Formerly, the whole maxilla was removed, and it was found that there were frequent recurrences.

For the last twenty years, the method described by Dr. Figi and originally by Dr. New has been used. In most of the cases, excepting those in which the condition is extensive, the approach is through the mouth. Should the approach be through the cheek, plastic surgical procedures give fair results.

The operation on Stenson's duct described by Dr. Figi is a useful one.

DR. JOSEPH C. BECK, Chicago: There are some points regarding a prosthesis that have been mentioned rather superficially. A properly made prosthesis used in cases of extensive loss of tissue of the face and orbit is of inestimable value. The use of the crest of the ilium in replacing the lost orbital rim is satisfactory.

Nothing was said about artificial implantations. Ivory implantations are tolerated well in many instances and will last over a period of years.

DR. ROBERT H. IVY, Philadelphia: The few tumors of the maxillary sinus that have been seen have been treated in about the same way that Dr. Figi described, but part of the treatment was carried out by the radiation therapeutist. I do not apply any of the radiation myself. My great trouble has been in dealing with necrosis following treatment with radium. This necrosis takes a long time to clear up. It does not seem to break down and form sequestrums nearly as readily as it does in patients with osteomyelitis.

Careful avoidance of any plastic procedure until all sequestration has occurred must be observed.

DR. CHARLES J. IMPERATORI, New York: I should like to ask Dr. Figi a few questions.

How long after the original operation does he do his plastic repair? My understanding of all such operations was that the dehiscence is produced in order to observe the interior of the antrum, to decide whether or not there is any recurrence before making a prosthesis or doing a plastic operation. Also, in his operation, I gather, he does not ligate the common carotid artery.

Regarding the reference to Stenson's duct: There is a case, Dr. Figi, on record in which the condition was produced not by a malignant disease but by an extensive gingival and alveolar retraction within the maxillary sinus, following a poorly done Caldwell-Luc operation. The same symptoms as described were present. The condition was corrected by a plastic operation done by Dr. J. E. Sheehan of New York.

DR. FREDERICK A. FIGI, Rochester, Minn.: I had not intended disparagement to the use of prosthetic appliances for the correction of these deformities. My paper dealt primarily with the plastic repair, however, and these measures were stressed on that account. There is no question but that the prosthetic appliances are extremely useful in many cases.

In answer to Dr. Imperatori's question, I like to wait at least a year after the operation before proceeding with plastic repair. However, I often wait much longer, many times several years. I do not ligate the carotid vessels in these cases, that is as a preliminary measure or at the time of the primary operation. I have found it necessary to ligate the external carotid artery in a few cases in which the tumor has recurred and has progressed posteriorly and eroded into the vessels. It is not done routinely.

FULMINATING INFECTION OF THE NOSE DUE TO MONILIA OR ASPERGILLUS: REPORT OF A CASE. DR. C. STEWART NASH, Rochester, N. Y.

This article was published in full in the August issue of the ARCHIVES, page 234.

DISCUSSION

DR. JOHN H. FOSTER, Houston, Texas: Just to add to the record, I have had the misfortune recently to see a case of infection of the pharynx with Monilia in which the patient died. The superficial type of mycotic infection, of course, is common in my portion of the country. I have seen Aspergillus niger in the antrum and other types of superficial infection. Recently, however, a general surgeon asked me to see a patient whom he had treated three weeks previously for peritonsillar abscess. He had incised the abscess with the patient under general anesthesia and evacuated a large amount of pus. In spite of that, the patient continued to suffer great pain over that side of the face and head, and there was continued discharge. When I saw the patient, there was an opening through the superior pole of the tonsil leading upward for about 1 inch (2.5 cm.). This opening was enlarged, but without any apparent effect on the condition. So I advised removal of the tonsil in order to secure better drainage and did remove it. At that time I found a sinus leading upward to the base of the skull. I noticed then that the discharge was filled with flaky material. This was found to be a fungous growth that was later identified as Monilia. The patient was then given heavy doses of iodide and a vaccine which was advised by some for this condition. Another sinus developed, going backward through the muscles up to the tip of the big portion of the temporal bone.

The patient gradually became worse; intracranial symptoms developed, and death followed paralysis of respiration.

DR. HARRY W. LYMAN, St. Louis: I should like to ask Dr. Nash whether the paralysis was of sudden onset or came on gradually.

DR. C. STEWART NASH, Rochester, N. Y.: The reason that this paper was presented was that I had never seen or heard of just this particular condition. In regard to the paralysis, whether it was sudden or slow, I shall have to answer that in terms of time. There was questionable facial paralysis on the opposite side (right), and that took place over a period of twenty-four hours. So far as the paralysis on the left side was concerned, that was about thirty-six hours in developing.

CARCINOMA OF THE LARYNX AND TOTAL LARYNGECTOMY. DR. SAMUEL J. CROWE, Baltimore.

The cases in which operation is to be performed must be carefully selected. When the growth has invaded the cartilage, muscles or glands, irradiation therapy alone is used. All intrinsic malignant growths are removed by hemilaryngectomy or total laryngectomy. The involvement of the anterior commissure or fixation of a cord is the deciding factor. The end results of laryngofissure have been disappointing in my hands, because I have used laryngofissure in borderline cases.

After the selection of the case in which the condition is suitable for operation, the other important factors which insure a good result are: careful preoperative preparation, simple surgical principles as regards traumatism of tissues, hemostasis and postoperative treatment. Great care is taken to close the pharynx tight so as to prevent leakage of secretions from the mouth into the wound or trachea; fluids are given through a small soft rubber nasal catheter which extends only halfway down the esophagus. This catheter is removed on the fifth day, if there is no leakage of secretions from the mouth into the wound. The patient is encouraged to get out of bed on the second or third day. A special nurse is in constant attendance until the feeding tube is removed.

If used at all in cases in which operation is indicated treatment with roentgen rays or radium is given after and not before the operation. This dissection is made with a knife and the hemostasis with catgut ties rather than with the high frequency cautery.

DISCUSSION

MR. VICTOR E. NEGUS, London, England: One of my greatest difficulties in recent years has been to form definite conclusions as to the correct indications for the treatment of laryngeal cancer. In my country, there are a very great variety of opinion and diversity of methods. There are some men who say that radiation treatment for cancer of the larynx is entirely wrong and should never be employed. There are others who say that anybody who operates on a cancer of the larynx ought to be put in prison. It is difficult to get a correct balance.

I have had the privilege of being associated with Sir St. Clair Thomson; he is a man of open mind. Some years ago, he was strongly prejudiced against radiation treatment, but not now, and he and I had to make some definite indications in rewriting his textbook. If I may, I will present them.

One point of interest, I think, is anesthesia. I was educated in King's College Hospital, London, which is a hospital which was honored by the presence of Lord Lister as one of its surgeons. Lord Lister had no anesthetic used except chloroform, given under a mask by the droplet method. I happened to be house surgeon to Sir Watson Chain, who himself was house surgeon and assistant to Lord Lister, and therefore the tradition is close to me. Sir St. Clair Thomson was also house surgeon to Lord Lister, and naturally those methods which were inculcated in early days have persisted.

In the operations on the larynx, whether by the substitute of laryngofissure or by total laryngectomy or by lateral laryngotomy, I have tried different means of anesthesia. One always thinks that possibly there is a groove into which one has gotten. I have at times digressed slightly from the use of chloroform, using ether, given rectally in oil or avertin with amylene hydrate, and come back again to what I have been taught, that chloroform is best.

I had the opportunity of seeing Dr. Crowe operate on a patient who had been given some avertin with amylene hydrate beforehand, and the patient at the end of the operation seemed to be in a light state of anesthesia and to have the cough reflex. The use of any premedication has been feared because of the possibility of diminishing the cough reflex, and that consideration has applied also to the use of atropine for drying up the bronchial secretions. As to the indications for various types of treatment, there are, in my practice, three methods.

The first is excision by means of laryngofissure. I think the details of this operation vary slightly with different surgeons, but as I have seen it with Dr. Crowe the area removed is identical. If a patient with a growth of this type came to me and I was satisfied that the growth was to be classified in group 1 or 2—for the classification appears to me to be highly important in assessing the right treatment—I should operate on that patient by means of laryngofissure, and should remove a wider area of tissue, irrespective of the size of the growth. The contraindications for the operation would be that the growth was of an aplastic type of group 3 or 4, or that it extended into the arytenoid. The occurrence of metastasis would be unlikely in connection with a growth of this type. The fixation of the cord would not deter me from carrying out the operation.

Secondly, if the growth were of group 3 or 4 (and one does see a certain number of group 3, with which the results of laryngectomy, as I have seen them, have been bad) I should not hesitate to treat the patient with irradiation, and if it were of group 1 or 2 I should possibly offer that to the patient and have done so in some cases. As to the method of treatment, I think that is rather less important.

Some of the patients have been treated with teleradium in 5 Gm. units, and some in 1 Gm. units, and there have been some good results reported, as there have been also with high voltage roentgen therapy given by the protracted fractional method; but the method of interstitial use of radium, which has been particularly developed by Mr. Doughlas Harner, in my country, is a satisfactory one, with little upsetting effect on the patient, and has given some excellent results. I think, therefore, that it has a place, but it does not compete in my practice with the operation, because the indications are so different.

Lastly, a word about total laryngectomy. If a patient came with a growth involving both cords, of group 1 or 2, without obvious glands, he would be treated by a total laryngectomy, not by irradiation. If the growth were affecting both cords and were of group 3 or 4, it would be treated by irradiation.

There is one slight difference in the technic. I have been in the habit of late years of using the incision of Sorensen, of Gluck's clinic in Berlin, a flap with lateral incision, transverse incision turned up so that the line of sutures in the larynx does not correspond to the line of sutures in the skin flap. The operation there is more extensively carried out than that which Dr. Crowe has described, the perichondrium being left intact and the muscles left attached for fear of cutting through any infected areas and particularly of touching the glands on the crico-arytenoid membrane. His operation, I think, gives excellent results, and I imagine that if the cases are selected carefully it has great advantages.

Therefore, to sum up, there are indications for three methods of excision: by means of laryngofissure for a limited and differentiated growth, irradiation for an extensive growth of one cord or both cords, particularly if it is of the anaplastic type, and removal of the whole larynx for a growth of low grade malignancy affecting both cords.

Dr. Chevalier Jackson, Philadelphia: From personal experience, I can corroborate all of the statements made by Dr. Crowe. It has been my good fortune to see 2 of the patients on whom he had operated by total laryngectomy, and the results, and I think has saved a good many patients from the necessity of total I think is as nearly perfect as the technic of laryngectomy can be.

The objectives that he stated are ideal when one is to do a total laryngectomy. In one way, I think what he has said should be supplemented with a little further elaboration of the technic of laryngofissure. He did not have time, doubtless, to go into that in addition to going into his technic of laryngectomy, but he stated that when the anterior commissure is involved laryngofissure is contraindicated.

Since 1913, I have had continual satisfaction in one case after another in performing laryngofissure with the growth located in the anterior commissure by modifying the technic, going through the skin with great care and, not to skeletonize the larynx, preserving all the soft tissues in contact with the external perichondrium, then going through the perichondrium in the midline with a knife and following that with the rotary saw, going through the cartilage but not through the inner perichondrium, then doing a subperichondrial dissection down on both sides—a little farther on the involved side—and then taking out all the soft tissue and an abundant area of normal tissue around the growth.

That modification of the operation of laryngofissure has yielded admirable results were admirable in every way. His technic, as demonstrated this morning, laryngectomy. I do not mean to cast any reflection on the operation of total laryngectomy. Unquestionably, it may be indicated, and unfortunately it is indicated for most of the patients by the time they are seen by a laryngologist. Only about 15 to 19 per cent of the patients who come in are fit for laryngofissure. All the rest require total laryngectomy.

One other point may be made in regard to irradiation. I feel, as Dr. Crowe does, rather adverse to irradiation in cases in which it is possible to operate, but I am not at all sure that the last word has been said on that subject. Personally,

I have had such good results from laryngofissure in cases of early intrinsic disease that I hesitate in such a case to advise irradiation; but I am not at all sure that the day may not come when that very condition will be treated by irradiation. That is not a forecast; I merely state it as a possibility, because I have seen clinically the work of others that leads me to question whether or not the day may come when irradiation will be used in cases in which the condition is now deemed best suited for operation.

REPORT OF A CASE. DR. GABRIEL TUCKER, Philadelphia.

I had a case in which primary carcinoma of the epiglottis was extirpated by transhyoid incision and laryngofissure. A preliminary tracheotomy was performed two weeks before the main operation. Splitting of the hyoid bone and the larynx was done as for a laryngofissure, and the epiglottis was then removed en masse.

The exposure by this method is good. The results obtained have been satisfactory, there being no recurrence in 1 case after five years and the other being too recent to report on.

REPORT OF A CASE. DR. DEFOREST C. JARVIS, Barre, Vt.

In 1928 Dr. Delavan, in his presidential address before this association, stressed the need of further study of the significance of the behavior of lymphoid tissue in the upper part of respiratory tract. Since that time, I have devoted considerable time to a study of this problem. After varied approaches, I observed that the size of lymphoid tissue in the upper part of the respiratory tract was related to the oxidation; therefore, using oxidizing catalysts of iodine and insulin, I applied this approach to lymphoid tissue and noted there was a decrease in size in from two days to a week.

This approach was also applied to cervical adenitis, and it was noticed that the cervical lymphoid glands decreased in size at a rapid rate. It was then applied to benign growths, like warts, and it was found that warts would disappear. It was later applied to benign growths of the thyroid, including a tumor in a case which I wish to present this morning as demonstrating the use of oxidation.

A man aged 45 on Feb. 22, 1937, discovered a small swelling on the front of his neck just below his Adam's apple. It continued to increase in size. There was no pain, no tenderness on palpation and no redness of the overlying skin. The patient was able to shave over the growth each day. Examination showed a tumor the size of a golf ball in the thyroid region in the front of the neck. On palpation, it was found to be hard and free from tenderness. Three drops of a solution of iodine one-seventh as strong as compound solution of iodine was given in a glass of water twenty minutes before the evening meal each day. Three units of crystalline insulin was given subcutaneously twice a week. Under this treatment, the tumor disappeared within four months and has not recurred.

MODIFIED TACHEOTOMY TUBE AND RETRACTOR FOR USE IN LARYNGOTRACHEAL STENOSIS. DR. BERNARD J. MCMAHON, St. Louis.

STENOSIS OF THE LARYNX, WITH SPECIAL REFERENCE TO SKIN GRAFTING. MR. VICTOR E. NEGUS, London, England.

The various methods of treating the difficult condition stenosis of the larynx will be reviewed. Continuous dilation is not satisfactory, because of its disadvantage in requiring many months or even years for success. Skin flaps are used for reestablishment of the obstructed airway. The use of a hinged inspiratory valve attached to a permanent tracheotomy cannula is recommended in certain cases to facilitate speech. Satisfactory results have been obtained in selected cases by the insertion of thin Thiersch grafts held in place by a solid obdurator or rubber tube.

EXPLANATION OF RESPIRATORY FAILURE AFTER TRACHEOTOMY. MR. VICTOR E. NEGUS, London, England.

Difficulty may be experienced after apparently successful tracheotomy from partial or complete cessation of respiration. It is possible for the patient to die unless correct treatment is instituted. (The mechanism of stimulation of the respiratory center by carbon dioxide was discussed. Records were given of variations in the carbon dioxide content of the blood in cases of laryngeal obstruction, with a description of the counteraction by buffer substances. The effect of sudden increase in the ventilation of the lungs as a result of tracheotomy was considered, and suggestions were given as to the prevention of dangerous symptoms.)

DISCUSSION

DR. JOHN F. BARNHILL, Miami Beach, Fla.: One time I had a patient who had respiratory failure as described, but I never could get a satisfactory explanation of what caused it. Several years later I heard a lecture on the carotid sinus and its relation to just this sort of breathing. That subject interested me greatly, and since then I have seen a number of instances in which the carotid sinus has been mentioned. Whether or not it had anything to do with this condition or whether the carbon dioxide acted through this carotid sinus I do not know, but in the discussion of this contribution of Mr. Negus it would, at least, be interesting to hear from any one who knows about the carotid sinus.

DR. MERVIN C. MYERSON, New York: I wonder if Mr. Negus can tell whether the stasis of the peripheral pulmonary circulation has something to do with this picture. Last year, Dr. Kernan presented the results of a study on the value of helium in persons with dyspnea due to an obstructive lesion of the larynx or trachea. As a result of his presentation, it occurred to me that it would be of value to have a carbon dioxide oxygen apparatus and a closed type of inhalation mask in the wards where the patients were cared for.

During the past year, 3 patients have been saved by overdistending their lungs in the presence of the obstructive lesion before tracheotomy could be arranged for or could be done or before even an intubation tube could be inserted. In other words, these patients were brought back immediately, and then a tracheotomy was done more or less deliberately.

MR. GEOFFREY BATEMAN, London, England: I wish to discuss a point arising out of Mr. Negus' first paper. I had the privilege of working with Mr. Hart in St. Thomas' Hospital. A case of stenosis of the larynx occurred twice which was rather different from any mentioned by Mr. Negus. The patient was a boy who at the age of 4 years had had a high tracheotomy performed because of laryngeal diphtheria. At the age of 7, he appeared at St. Thomas Hospital, where a low tracheotomy was performed as the first step in the treatment. Later a laryngostomy was performed, and it was seen that the patient had a stricture at the level of the vocal cords, which was completely obstructing the airway. Not the smallest bougie could be passed through. Therefore, the associate plastic surgeon, Mr. Kilner, was asked to cooperate in this case. A laryngostomy was performed, and under a dental stent mold a skin graft was put into the larynx through this incision, which was left open. After a week, the stent mold was removed and replaced for another week. Then the stent mold was removed permanently.

During the course of the next fortnight another stricture developed, which also practically completely obstructed the airway. At this stage I was asked if I would cooperate. The problem appeared to be to keep the larynx dilated around the skin graft for a sufficiently long time to prevent the formation of any further fibrous tissue beneath the skin graft. In order to do this, a tracheotomy tube was made which had an upward extension. The laryngostomy incision was 25 mm. long, and the stricture was at the upper end of this laryngostomy extending upward about 12 mm. The area at the glottic fold was about 17 mm. above the top of

the laryngostomy incision; so a tube was made which had an upper extension, sliding in which was a second tube, which was fixed by a tube on the front of the extension. The larynx was open higher up. A mass of scar tissue was excised and the tube fully extended, with a skin graft wrapped around and put into the laryngostomy incision. Then the larynx was closed again over this tube. At the end of a week, by letting the upper part slide back again, the tube was removed and the site of operation cleaned up, and then the tube was put back again and left, this time for another fortnight, by which time everything was soundly healed, and it was possible then to put in a rubber tube with an upward extension. This was left in for approximately two months, after which time it was assumed that there would be no further contraction, and the tube was removed and the laryngostomy wound left open for another three months while observation was continued to make certain that there would be no further contraction. There was no further contraction then, and at this stage Mr. Kilner closed the laryngostomy opening completely by turning in a skin flap, undercutting the skin and bringing it over the top so that the patient now has a larynx without any vocal cords. It is a perfectly clear airway, and he has a strong whispered voice. He apparently makes use of the aryepiglottic fold.

It is now six months since the laryngostomy opening was closed, and the boy is breathing normally and is perfectly well.

Dr. Frederick A. Figi, Rochester, Minn.: I was particularly interested in the discussion of stenosis of the larynx presented by Mr. Negus and in this connection should like to speak about some drawings that I had made of a patient taken care of recently.

I had the pleasure of hearing Professor Schmieglow's presentation of the lecture which Mr. Negus referred to and feel, as apparently Mr. Negus does, that the combination of skin grafting and india rubber tubes, rather than the use of the rubber tubes alone as Professor Schmieglow advised, is definitely advantageous.

The patient was seen originally as a child 3 years of age, with multiple papillomas. At that time, radium was being used in the treatment of papilloma. The papillomas cleared up, but after a few years there developed perichondritis, which resulted in practically complete closure of the larynx except for a minute channel. It was not until the patient was approximately 20 that she returned for treatment of her laryngeal stenosis. At that time I advised an open operation, for bougies could not possibly have been of a great deal of benefit.

On opening her larynx through laryngofissure, I found a tiny tract that would just admit a small probe. All about that was markedly thickened cartilage. Obviously, one could not possibly dilate this stricture. It was necessary to core out the cartilage, that is, to excise the thickened inner portion of the cartilage, leaving an outer shell only. This was so thin that it was questionable whether there would be ample support for a lining even if the lining were restored.

A skin graft wrapped around sea sponge, which was compressed in order to keep the graft under a little tension, was sutured into the wound.

At the end of ten days the sea sponge was removed, and surprisingly enough this skin graft that had been applied directly to the cartilage had taken perfectly. It had not been thought previously that a skin graft could take when applied to a pure cartilage base, but this had taken perfectly; the sea sponge was replaced with a short, soft rubber tube covered with a finger cuff, which was drawn out through the tracheotomy opening that had been established previously. A tracheotomy tube was inserted at a lower level, but the fistula was left above, and through this the cuff at the lower end of the tube was drawn out and a suture placed directly through a small rubber tube in order to insure its remaining in position.

The patient wore this for six months, and a few months ago I was able to remove her tracheotomy tube. She has no voice, but she does have a perfectly free airway.

In this connection, it might be interesting to give a statement regarding a patient that Professor Nager told me about. This patient had severe laryngeal stenosis and after treatment for this had no sphincteric action remaining in the larynx, so that when he drank fluids they ran directly down into his respiratory tract. I rather feared that the same phenomenon might occur in this case. It has not, however. The patient has had good function, and I anticipate that in the course of time she may develop some voice.

MR. VICTOR E. NEGUS, London, England: From the lack of comment on the part of other fellows of the association, I take it that the feeling is rather in favor of these methods, which really give little difficulty and considerable advantage. As to the remarks about the carotid sinus, I have no information on that.

Dr. Myerson spoke about the stasis of the pulmonary circulation. In the mechanism that I was speaking about in connection with changes in carbon dioxide content, that would be secondary to failure of respiration. There is no sign of stasis, as evidenced by lack of cyanosis, but I suspect that it is a slightly different problem he is referring to. Helium I know nothing about.

Mr. Bateman was speaking about a case that I know of. I am not alone in England in using this method, because once a matter of this sort gets recognized it spreads quickly. Laryngologists are lucky there in having the cooperation of men who devote themselves to plastic surgery, and, like Mr. Bateman and Mr. Kilner, so have I sought their advice and cooperation.

I was extremely glad to see Dr. Figi's diagrams and hear his remarks, because I knew well that he had used this method for a considerable time, and I think that one thing I shall have learned is that one can extend it to other cases. I have 1 or 2 in which I thought that I could not restore the airway for purposes of respiration and only for purposes of voice. He said that in his case he thought the voice would come back. I certainly think that the voice is of greater importance to the patient than the power of breathing through the larynx, because it is easy for the patient to breathe through the tracheotomy tube, but if the patient is without voice he is in an unhappy position. I have not the slightest doubt that the voice will be restored in the case he was referring to.

I heard of a case that Sir Harold Gilles had with Mr. Capps in the Bartholomew Hospital, in which they had this problem of the lack of sphincteric action. I rather fancy that when the fibers of the muscle in the aryepiglottic folds have been destroyed so that the laryngeal aperture is unable to close one could carry out a plastic operation of transplanting some of the anterior sphincter to form a new sphincter. I can see no reason at all why in the act of swallowing the contraction of the anterior sphincter should not be made use of to close the aperture of the larynx. That would require working out.

I think I am right in feeling that your association would be genrally in favor of the use of skin grafts in combination with the other methods.

FINAL RESULTS OF FIBROMA OF THE LARYNX IN A CHILD OF THREE YEARS; TRACHEOTOMY; REMOVAL BY LARYNGOFISSURE; PROLONGED INTUBATION. DR. THOMAS J. HARRIS, New York.

The case about to be discussed was reported at the 1905 and 1906 meetings of this association. Since then, I have continued to see the patient from time to time. When originally presented, the case created considerable interest on account of a number of unusual features. It is seldom possible to follow a patient for so many years. On that account, as well as for several other reasons, a final report would seem to be in order. Reference will be made in the first place to the fact that an indirect laryngeal examination of so young a child was possible and material for biopsy successfully removed. In spite of his ardent advocacy of the direct method, Dr. Jackson has always insisted on the importance of an examination by means of a mirror. The first outstanding feature of the case was the infection proceeding from the trachea, which involved the site of the laryngo-

fissure, undoubtedly because of the close proximity of the tracheal incision to the laryngofissure. A further point of interest was the extensive stenosis that followed the operation and the ingenious method employed by Dr. John Rogers to dilate the stenosis wound. Finally, reference will be made to the changing nature of the growth, which appeared first as a fibroma and recurred as a papilloma, as shown by the microscopic examinations made in the laboratory of the hospital. A careful search at the time of the original report failed to find any similar case in the literature.

DISCUSSION

DR. HENRY L. SWAIN, New Haven, Conn.: I do not remember whether it was the same case. In any event, I supposed I had the honor of having seen a patient longer than anybody else, but whether yours is my case or your own it has been so many years that I cannot say.

My patient was a child of 4 years who had a laryngofissure done to remove papillomas which had become so numerous that the condition could not be treated in any other way. She then passed from my notice and twenty-two years afterward returned. She said (in a whisper), "You don't recognize me." But I did. She was in excellent health, married and the mother of two children, but she would not attempt to go without her tracheal tube. What interested me particularly was to see what the effect had been of growing up to the adult stage from the age of 4 without having had the normal use of her larynx. I expected to find a much atrophied or a poorly developed larynx. It was not very different from what one would expect of a woman of her size and age had she had the normal course in life. The thyroid wings and everything about it seemed to be quite right and proper.

I tried to induce her to go without the tube, because there was no real obstruction. I was not successful. She appeared several years later, and by frequent dilations she succeeded in getting sufficiently brave to go without the tube. I saw her five years ago. She could make herself understood fairly well and was healthy.

DR. JOSEPH C. BECK, Chicago: I want to speak concerning two types of pathologic entity which are described in this paper, angiomatous fibroma becoming papilloma. Of course, in the literature it is recorded often that papilloma becomes malignant, but this kind of transformation is not common, and I have received two reports from two different laboratories, and it is the pathologist-histologist sometimes that makes that mistake.

I should not be so strong about emphasizing these two different pathologic entities. I think at the time we probably dealt with a papilloma or an angiofibroma.

USE OF THE HYOID BONE AS A GRAFT IN LARYNGEAL STENOSIS. DR. EDWARD A. LOOPER, Baltimore.

This article was published in full in the July issue of the ARCHIVES, page 106.

DISCUSSION

DR. THOMAS E. CARMODY, Denver: I understood in the first place that the bone was cut loose, but from the picture there is still some attachment left.

DR. EDWARD A. LOOPER, Baltimore: Yes.

DR. THOMAS E. CARMODY, Denver: I have a suitable patient, and I thought of using a piece of rib. This method would seem to be much better if one can leave the graft attached. Does that interfere with deglutition at all?

DR. EDWARD A. LOOPER, Baltimore: For a short time—a couple of weeks.

DR. MERVIN C. MYERSON, New York: What is the exact anatomic condition within the larynx for which this operation is indicated?

Dr. Edward A. Looper: I think it is principally useful for patients who have had more or less external deformities and those whose condition involves a great many traumatisms and irregularities, principally of the thyroid cartilage. For children or persons with post-tracheal disturbances, this method is not indicated.

Postural Treatment for Acute Laryngotracheobronchitis. Dr. T. C. Galloway, Evanston, Ill.

In discussion of the physiopathology of acute laryngotracheobronchitis emphasis is to be placed on the secondary effects of obstruction and increased negative intrathoracic pressure in the presence of thick secretion and infection. The process is most marked in dependent portions of the lung and depends in part on gravitation of secretion. Postural drainage is extensively used by thoracic surgeons but has had little attention in connection with this condition. With it, secretions flow toward the larynx or tracheotomy opening. Crusts, if formed, are higher and more accessible for removal and block a smaller pulmonary field. Irrigation of the tracheobronchial tree if followed by postural drainage and aspiration is reasonably safe and efficient. A colored film will be shown to demonstrate preliminary bronchoscopy, deliberate tracheotomy, postural irrigation and drainage. Ten cases will be reported of acute laryngotracheobronchitis requiring tracheotomy, with 2 deaths.

DISCUSSION

Dr. Lyman Gilder Richards, Boston: Dr. Galloway's mortality record of only 20 per cent, even in this small series, is, to my knowledge, the best figure that I have come in contact with. He mentioned Dr. Smith's figure of 30 per cent, but I am sure that when that series is examined it is evident that it included certain cases in which the condition would not be characterized as fulminating tracheobronchitis.

It must be recognized that, in addition to the mechanical effect afforded by this condition, one has always to deal with a generalized edema and thickening of the broncheal and broncholithic walls, which is still a problem that must be wrestled with. I hope, since these infections are mostly streptococcic, that sulfanilamide may be a useful adjunct. In the cases in which I have tried it, the results have been rather doubtful. I think that transfusions of immune blood may likewise prove to be useful in treatment.

I am glad Dr. Galloway mentioned the matter of certain solvents for encrusted material, particularly in conjunction with the gravity method of drainage, and I have used sodium perborate. I have used a proprietary medication which purports to have the composition of normal blood serum and found it to be useful in releasing this encrusted material. That, in conjunction with this postural method of drainage, will certainly help to maintain a patent airway. I notice in one of the cases Dr. Galloway described the pathologic condition of the larynx as edema and swelling. That, in general, has not been my experience. I have seldom seen any real supraglottic swelling. The condition has been involvement of the edges of the cord with attachment of this encrusted secretion on it, or else the secretion is attached to the subglottic walls below that point. Pathologically, the condition seems to me to differ considerably from the ordinary form of acute edematous swelling which is associated with streptococcic lesions.

Dr. William B. Chamberlain, Cleveland: Dr. Galloway has emphasized the introduction of the bronchoscope, and certainly there is a great advantage in performing a tracheotomy with the bronchoscope within the trachea. One is not hurried at all.

I want to emphasize again the procedure which I spoke of at a recent meeting of the American Laryngological Association, whereby the Mosher life saver was used instead of the bronchoscope, because it is much easier to introduce and also because one could introduce it not by sight but by touch.

DR. THOMAS E. CARMODY, Denver: I should like to ask Dr. Galloway about his catheter. Is the ordinary catheter used with the blunt end for suction?

DR. T. C. GALLOWAY, Evanston, Ill.: I cut off the catheter at an angle.

DR. BERNARD J. MCMAHON, St. Louis: I should like to say a word relative to the suggestion of using sulfanilamide. I notice that in these cases when a streptococcus was present the infection was always mixed.

Another interesting factor was that one of the early toxic reactions to sulfanilamide was hyperpnea. Whether the use of this drug would be a justifiable way to stimulate the respiratory rate in these patients is something else which must be considered, but the respirations are affected when there is a certain amount of toxic reaction.

DR. T. C. GALLOWAY, Evanston, Ill.: Five of these attacks occurred within three weeks of Christmas. Sulfanilamide was used in all the cases without any benefit. I am enthusiastic about sulfanilamide because I have seen 9 patients with meningitis recover after its use since January a year ago, but I thought it had no effect in these particular cases.

The patients are practically all dehydrated, and fluids by mouth are important, as are also transfusions.

Sodium perborate was mentioned. Dr. Beck pointed out years ago that using hydrogen peroxide in the throat was likely to produce a sort of emulsion, a foam, which might actually asphyxiate the patient. I wonder, Dr. Richards, if there is any danger in that.

DR. LYMAN GILDER RICHARDS, Boston: I have seen no bad effects from it.

DR. T. C. GALLOWAY, Evanston, Ill.: I have a feeling that this disease is not a septic condition, as a rule, primarily but that the sepsis is due to secondary infection, that the secondary changes are virulent and that it is not the infection per se that makes the patients so ill.

As to the bacteriologic picture, there is some interesting work from Rochester, Minn., I think, by Bradford and Lahey, who expressed the opinion that the ordinary methods of taking cultures in these cases is wrong. In a series of 26 cases, they found that Streptococcus viridans was the predominating organism when cultured. Streptococcus haemolyticus was not the important organism, and that may explain the particular tissue reaction to the organism and the particular viscid secretion which is so characteristic of the disease.

The life saver is valuable, but it is important in these cases to get a look into the trachea if one can with a bronchoscope, and it is very important to be able to carry oxygen in and to aspirate secretions even before one does the tracheotomy.

LARYNGEAL PERICHONDRITIS. DR. CHEVALIER JACKSON, Philadelphia.

I shall discuss the causes and treatment of primary perichondritis, as well as the conditions to which perichondritis may be secondary. Palpation is important in diagnosis. Treatment should be conservative but the airway must be maintained. There are various complications. In the treatment of sequelae increase of an existent lumen is best accomplished by progressively increasing the sizes of the core molds. I shall describe the technic of core molding in cases of total atresia. (A chalk demonstration of typical cases was presented.)

DISCUSSION

DR. FRANK R. SPENCER, Boulder, Colo.: My experience is similar to that of Dr. Jackson regarding the incidence of perichondritis having decreased materially over a period of years, undoubtedly because of early diagnosis and preventive medicine. Thirty years ago, perichondritis meant the patient's death. Laryngologists today do not see it often.

DR. JOSEPH C. BECK, Chicago: Dr. Jackson may remember, and I have memories of, a physician that had an infective type of perichondritis, a streptococcic

sore throat, that started with pharyngitis and extended until perichondritis developed in a severe form. A tracheotomy saved the situation.

I am asking Dr. Jackson why he called this condition perichondritis when he removes a sequestrum and always there is chondritis. The term that Meyer used in classifying this disease is chondroperichondritis.

Dr. Charles J. Imperatori, New York: I had hoped that Dr. Jackson would go into detail regarding the treatment of these conditions, particularly regarding the use of core molds, as yesterday in discussing the treatment of these types of atresia the various authors and those who discussed it suggested that laryngostomy and implantation of skin flaps or the Thiersch graft be used.

I had a patient whose condition was similar to that of Dr. Figi's patient, a child with the larynx obstructed with papillomas. Irradiation was used; that is, radium was inserted within the larynx. This was some fifteen years ago. Marked atresia of the larynx eventually developed. When Professor Schmieglow was here, this patient was presented to him, and he operated by his method. Whether or not it was because he did not himself carry out the after-treatment, which, of course, is important, the patient was made much worse, so that there was a passage of a few millimeters in diameter throughout the whole larynx.

Then a junior assistant of mine operated on this same patient, repeating Professor Schmieglow's operation, with the result that complete atresia of the larynx developed. The boy grew up wearing a tracheotomy tube. He had a buccal voice, and in the course of time he came to a hospital where I was and applied for treatment. I used the Jackson core molds on this boy. It was necessary to perforate the cicatricial area, introducing the core molds one after another, and after nine or ten months, the boy could go without his cannula.

He has remained well now for a year and a half, without a cannula or a tracheotomy tube.

Another case was similar; a woman sustained an injury in an automobile accident, but she would not submit to the continuation of the core molds. She has now moved away from New York, and Dr. Hollander is taking care of her in Chicago.

Still another case was that of a woman who swallowed a foreign body. It was inexpertly removed, and the esophagus was perforated. Emphysema of the neck resulted, but an immediate mediastinotomy was done and also a tracheotomy; these operations also were inexpertly done. Complete atresia of her larynx due to chondroperichondritis resulted. This patient also was treated similarly with the core molds. So it would seem to me that this method has a great deal of merit, and it may be that the use of the soft rubber will be combined with the laryngostomy and the plastic operation and the insertion of the Thiersch graft. However, the results are so good, and I have absorbed so much conservatism from the English guests, that I think I shall continue with this core mold treatment rather than attempt extensive plastic operations, the results of which seem to me, unless they are done expertly, too frequently to be failures.

Dr. Gabriel Tucker, Philadelphia: I just wanted to ask Dr. Jackson if he would say something about postoperative perichondritis, perichondritis that sometimes follows operation on the larynx.

Dr. Mervin C. Myerson, New York: I am glad that Dr. Jackson mentioned, as he terms it, the flip test. In cases of paralysis, a certain resiliency and lack of resistance of the vocal cord are noted in the attempt to pass a rigid instrument through the glottis, but in the presence of fixation of the cricoarytenoid joint due to previous inflammation and healing there is a fixation which is resistant, and I thought it would be worth while mentioning it because frequently one is called on to make a bronchoscopic examination of tuberculous patients who have a fixation of one or both cords which narrows the glottis greatly.

It is important to use a bronchoscope only of the size which will pass that constricted glottis. If one attempts to use the usual 7 mm. bronchoscope in an adult larynx when it is so constricted, one may be forced to do a tracheotomy later.

DR. THOMAS C. GALLOWAY, Evanston, Ill.: There is one question that has been raised recently in the survey of statistics on cut throat at the county hospital. My associates and I have reviewed 28 cases. The statements that Dr. Jackson made, that there should be no primary closure and that one should wait for the subsequent secondary infection, seemed to me absolutely logical and proper, and I have insisted that for patients in my service there be no primary closure, but on surveying our statistics we were greatly surprised to find that in the cases in which there had been primary closure the patients did considerably better than in those in which the surgeon had waited. I should like to know from Dr. Jackson whether that is an accidental finding in a small series or whether it is right.

There is this to consider, that if one makes primary closure the wound is not flooded by secretions, and in many instances the wound is lacerated. One striking factor from our statistics was that of 11 patients with cut throat above the thyroid cartilage 10 died. The mortality was about 50 per cent in the series we had.

DR. CHEVALIER JACKSON, Philadelphia: The point raised by Dr. Beck is, of course, a very good one. Unquestionably perichondritis means chondritis and necrosis, and it is the necrosis of the cartilage which makes perichondritis serious, the fact that the cartilaginous framework is destroyed as soon as the perichondritis has advanced to a certain stage, because the cartilage loses its nutrition and becomes a foreign body and a septic one at that.

Dr. Imperatori has raised a number of interesting points. He spoke about different methods of treatment and mentioned the esteemed fellow Professor Schmieglow. Comparisons are odious and distinctions invidious; I have nothing to say on that score except what is favorable to the use of core molds. They have been a revelation in the management of cases of chronic stenosis.

Time did not permit me to go into the matter of treatment, but in a general way in the acute stage it is conservative. In the cicatricial stage, the core molds are ideal, whether there is any lumen or not. One can create a lumen and enlarge that lumen with core molds.

As to the point raised by Dr. Tucker in regard to postoperative chondritis, that is an enormous field in itself and a very important one, with which, of course, every laryngeal surgeon is fundamentally concerned, but there will not be time to take up any points in regard to it.

I agree with Dr. Myerson perfectly in regard to care in the use of oversized bronchoscopes.

Dr. Galloway spoke about getting along without primary closure. That can be done, and often it will be successful, and the patient and the surgeon are fortunate if that procedure is followed, but the mortality will be high in the case of infected wounds. That does not apply to clean operations, in which one cuts the cartilage and even though the airway is not sterile, one's technic is sterile, one's management of it is sterile. Laryngofissures are closed now whereas they used to be packed open always, but that is believed to be an improvement in the aseptic technic. But in the cases of trauma in which the patient comes in cut by the windshield or in attempted suicide or murder and in all cases of accidental trauma, one does not know what infection is in the wound, and it is much safer to pack it open and keep it aerated until one finds out. In two or three weeks, healthy granulations can be formed and then it can be closed without danger. By that time one knows what infection is present, and a certain degree of immunity has been established.

Dr. Green was telling me a few moments ago that they see many of these cases in China.

CANCER OF THE LARYNX: IMMEDIATE AND ULTIMATE RESULTS OF OPERATION IN ONE HUNDRED AND TWO CASES. DR. HENRY BOYLAN ORTON, Newark, N. J.

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DISCUSSION

DR. GABRIEL TUCKER, Philadelphia: At the present time, especially in cases of early involvement, there is a tendency for the roentgenologist to administer treatment. When a percentage of cure by laryngofissure of over 80 can be shown, I think there should be some hesitancy in letting the roentgenologist take these cases of early involvement.

The cases observed, 315 consecutive cases, go back to the time of my first association with Dr. Jackson, and, by his permission, some several years ago, I reported a series of 200 cases that had been observed at the bronchoscopic clinics at the University of Pennsylvania. The cases mentioned here are only the ones in which I operated myself, including those 200 cases. Some of the patients, those whose condition was of long duration, were in Dr. Jackson's service at that time at the University Hospital.

Of 315 cases, the condition was considered to merit surgical intervention in 154. In 144 the condition was intrinsic and in 10 extrinsic.

The cases of extrinsic involvement in which a total laryngectomy has been done are the ones in which the lesions occur in the aryepiglottic folds, involving the ventricular bands and in some cases the under surface of the epiglottis.

There were 92 cases of laryngofissure, with recurrences in 11, and cure to date in 81.

There is just one other observation I should like to mention, and that is that in cases of cancer of the larynx that has been treated by irradiation, when there is a recurrence it is at the original site of the lesion. Recently, in the cases of recurrence following laryngofissure, excellent results have been obtained by irradiation. The recurrent growth seems to melt away more rapidly than the original lesion.

MR. VICTOR E. NEGUS, London, England: The results that Dr. Orton has obtained seem to be extraordinarily good, and I envy him his success.

There are one or two points to which I should like to refer. One is the small number of cases of postcricoid carcinoma he seems to have encountered. British laryngologists seem to get a large number, comparatively; just in the last few years, about 22 cases have come to my knowledge, including those in which it was not possible to operate.

In connection with what was said about the right cord there is one little point of interest which has been brought out by two or three investigations. A laryngologist in the Conservatory of Music in Moscow, I think, reported cases showing that the average person does not use both cords equally, that one cord vibrates much more than the other, and I have seen myself with the stroboscope cases in which one cord is stationary and the other moving a great deal, and it is possible that the right cord in right-handed persons may move more. That is merely a suggestion.

Diabetes, of course, is usually a contraindication to laryngectomy. I have removed the larynx of a patient with severe diabetes, and the result was good. Several years afterward, the man had a recurrence in glands on one side of the neck, which I had to remove by block dissection, and he is perfectly well now after twelve years.

As to speech, there is a speech therapy department in my hospital in London where laryngectomized persons are educated, and an attempt is usually made to get them to learn esophageal speech on the grounds that it is simpler and more natural than speech with an artificial larynx. Many of them get on very well indeed.

There is one question I should like to ask Dr. Orton, about which there is great doubt in my mind, and that is whether he has all the teeth removed before operation or only any teeth that may be carriers of infection. Mr. Trotter, who has had a great influence on all the laryngologists in England, has laid town an axiom, that before laryngotomy and other operations of that type, as well as before operations to form a pharyngeal diverticulum, all the teeth should be removed to avoid sepsis in the wound and infection of the larynx.

The removal of the hyoid bone seems to be a useful modification, because it is at that point, I think, where one encounters the greatest difficulty of healing, but I have not known before this that it was carried out habitually.

The method of removing the larynx from above down has generally been used, but it does not seem to make much difference, and in certain cases in which there has been obstruction MacKenty's method has been employed—at the beginning of the operation skeletonizing the larynx, inserting a big rubber tube and then continuing the operation from above down. That method is much the same as Dr. Orton's, I think, by which he opens the trachea before finishing removal.

Another little point is cutting the trachea obliquely so that the resulting opening is bigger than it is if it is cut transversely. A taper tube with a double flange is used. It also keeps the dressings from falling over the opening of the tube.

The series of cases reported by Dr. Tucker also is marvelous, I think. It is extremely encouraging, and confirms the opinion that it would be wrong to abandon an operation of that type which produces such wonderfully good results as regards the absence of recurrence, and also, as I have had the opportunity while I have been here of seeing myself, extraordinarily good functional results.

Dr. Joseph C. Beck, Chicago: May I ask a question? I think I did not hear anything about the application of radium and the experience as to healing and so forth in those cases in which roentgen or radium therapy had been previously used.

Another point in connection with the introduction of the feeding tube into the picture: Does Dr. Orton let the patients swallow immediately, or what procedure is adopted?

Dr. Fletcher D. Woodward, Charlottesville, Va.: After trial of many types of procedure, many types of treatment, the point has been reached at which in cases in which cancer has advanced into the neck and a large mass is present, a laryngectomy is done regardless of tumor. Incision is made through tumor; no attention is paid to it. The tracheal stump is sutured to the skin, the wound closed and the treatment then followed with a fractional dose of roentgen therapy after the method advocated by Dr. Coutard. By doing that, I believe, some valuable results have been attained. There are 2 patients who have been apparently cured for four years, and there are a good many others scattered along since that period, of course, in whose cases insufficient time has elapsed to attest the permanence of the cure, but who are still free of cancer so far as is known.

It is a question of what to do with the cases in which the condition is advanced. I should like to have Dr. Orton say a few words as to what he does when the prognosis is apparently hopeless.

Dr. Henry B. Orton, Newark, N. J.: I do not want Dr. Tucker or any of the physicians who do laryngofissure to think that I am trying to discredit laryngofissure. Apparently all the patients for whom laryngofissure is indicated go to Philadelphia, and probably the laryngologists in Newark get the ones whose condition has passed beyond the state in which laryngofissure is beneficial. In other words, the patient on whom I do a laryngofissure is the one who has a small growth.

In reply to Mr. Negus, only 2 carcinomas of the postcricoid type have come to operation. There have been more, but I have not operated on them because the patients seem to be too near death or have massive glands on both sides of the neck.

As to the teeth, the patients come into the hospital four or five days before operation and even before that if the teeth are bad. The very worst teeth are removed, and the rest are cleaned up. It is not the practice to remove all the teeth.

I have tried cutting the trachea obliquely as well as Lewis' method of making a flap. Making a flap prolongs the operation a little.

As to roentgen treatment, a few preoperative treatments and sixteen postoperative treatments have been given.

The feeding tube was placed in the nostril by the anesthetist and left there for two weeks or more.

Dr. Joseph C. Beck, Chicago: Dr. Orton seemingly did not understand my question. I wanted to know what was the effect on the operation or the postoperative healing of the extensive preparative application of roentgen rays and radium.

Dr. Henry B. Orton, Newark, N. J.: I have given a preoperative roentgen irradiation only twice, and healing was perfectly satisfactory, but the roentgen rays were applied possibly a week or ten days before I operated. I will not remove a larynx after massive irradiation has been given.

Dr. F. D. Woodward: The cases of advanced carcinoma constitute a problem I have had on my hands for many years, being chairman of the Cancer Control Committee for the State of New Jersey. I am still trying to find a place for the patients whose condition is hopeless, beyond any possibility of operation or even of cure by irradiation.

An Analysis of Seventy-Five Cases of Bronchiectasis from the Standpoint of Infection of the Sinuses. Dr. Robert L. Goodale, Boston.

Seventy-five cases of bronchiectasis have been analyzed from the clinical point of view. Studies show that 60 per cent of the patients were in the first two decades of life. Patients in the first decade more frequently have pneumonia at the onset, and for those in the second decade infections of the upper part of the respiratory tract alone are more frequently the cause of bronchiectasis. Infections of the upper part of the respiratory tract lead all others in causing bronchiectasis. Thirty-seven patients had infection of the upper part of the respiratory tract at the onset, and 29 had pulmonary infection alone at the onset. Other diseases present at the onset included pertussis; the condition sometimes followed tonsillectomy also. In 45 cases there was roentgenographic evidence of sinusitis. The incidence of chronic sinusitis is in direct relation to the frequency of infections of the upper part of the respiratory tract subsequent to the onset of bronchiectasis rather than to the presence of the disease at the onset. The location of the bronchiectasis also has a relation to the causative disease and to the presence of sinusitis.

Discussion

Dr. Harris P. Mosher, Boston: The way this paper came about was this: Dr. Churchill, of the thoracic clinic, said, "I do not believe that bronchiectasis arises from disease of the sinuses. Do you know of anybody who can determine this matter for me?"

He put it in such a challenging way that there was nothing for me to do but to produce a man to work on this question, and the man was Dr. Goodale, and you have heard the result of his investigations. He has proved to my mind, that the old-fashioned idea that bronchiectasis was practically always caused by disease of the sinuses is a fallacy. It has been partly proved for a long time that there was a direct anatomic connection between the sinuses, the pharynx and the lungs, but it remained for LaSalle last year to prove the existence of direct bacteriologic invasion from the sinuses to the pharynx, to the lungs, then to the heart, and from

there on. To sum it all up, I feel that Dr. Goodale has changed the ideas about the incidence of bronchiectasis and disease of the sinuses materially.

Dr. Henry M. Goodyear, Cincinnati: I was interested in the remarks that Dr. Goodale made in regard to the treatment in cases of this type, rather the radical operation that he proposes for the patients. A number of the patients are children, the condition being more frequent, perhaps, in the first decade. I do not believe that a distinct infection of the antrum ever occurs without some ethmoid involvement occurring at the same time.

In the treatment of these cases, I do not believe it is justifiable to exenterate the ethmoid cells of these children. I think that they should, at least, be given the chance of having a drainage from the antrum by a large window in the inferior meatus and that the ethmoid should be given a chance to drain and recover. A large number of the patients will recover without the ethmoid cells being completely or partially exenterated. I think, after that has once been done in childhood, the whole sinal picture of the patient is upset for life, and often he is somebody's patient off and on for the rest of his life; he has frequent colds, and with his ethmoid cells partly exenterated he has trouble.

I believe bronchiectasis in children is such a serious condition that if I had a child with beginning bronchiectasis and I had done this drainage in the antrum I should even go a little bit further and send the child west or live in some dry climate for a year. I would make almost any sacrifice rather than let bronchiectasis develop, for it is really something a person has for life.

Another thing that I am interested in that Dr. Goodale did not mention is the type of organisms he finds. I wonder how often in these cases there is a staphylococcic infection.

Dr. Thomas C. Galloway, Evanston, Ill.: I should like to raise two questions: One is what type of pneumonia was included, and the other is whether or not Dr. Goodale has made any particular observation in these cases as to the presence of allergy and whether or not the associated condition in the sinuses and the lung could have a common cause in allergy.

Dr. John F. Barnhill, Miami Beach, Fla.: The condition as I have always understood it is that there is an infection, not necessarily an infection from a sinus; it might be from the tonsils, the teeth or the mouth.

Dr. Robert L. Goodale, Boston: Dr. Mosher has told you the history of the study. It has been a great privilege for me to have the opportunity to pursue it.

In regard to Dr. Goodyear's remarks as to operation on the ethmoid in children, I entirely agree, as far as children are concerned. I mentioned that this was a group largely of adults. It is noted that most of the patients had had their bronchiectasis for more than five years. I feel that an adult presents a different problem from that presented by a child. My remark in regard to the operative procedure was based largely on cases in which I have operated myself or seen the operation done at the hospital. The patients were all adults.

Dr. Galloway asked what type of pneumonia was present. It was not possible to get that information from the history. A number of the patients came into the hospital for the first time years after they had acquired their bronchiectasis. They did not know what type of pneumonia they had had.

I should say, however, that it is true that in those cases in which I did note some difference in the type of pneumonia the tracheobronchitis with atelectasis was more frequently associated with lobar pneumonia or in some cases with localized bronchial pneumonia, but I could not answer that question accurately.

As far as the allergic picture is concerned, few of these attacks are allergic. I think, as I showed on the chart, only 2 were asthmatic. In the other cases I found no evidence of allergy.

In regard to the possibility of infection of the upper part of the respiratory tract rather than sinusitis as the cause of bronchiectasis, a great many of the patients, as I have shown, had acute infection of the upper part of the respiratory

tract of a severe type and yet did not have sinusitis, and I believe it is possible that that might be an etiologic factor. Certainly all bronchiectatic patients are extremely susceptible to infections. That is another point to consider in connection with operation. The patients will not stand much operation, and they will not stand infections.

THE ANAPHYLAXIS REACTION: TISSUE CHANGES AS OBSERVED IN LIVING TISSUE IN THE RABBIT. DR. HARRY P. SCHENCK and RICHARD ABELL, PH.D. (by invitation) Philadelphia.

The experiments demonstrated by direct microscopic observation certain arterial and cellular changes in the moat chamber in the rabbit's ear. In the actively sensitized animal, these changes follow intravenous injection or introduction of anaphylactogen into the moat.

DISCUSSION

DR. HENRY M. GOODYEAR, Cincinnati: I should like to ask Dr. Schenck if he has tried histamine in these experiments. From some of the experimental work that has been done it appears that by giving doses of histamine, one can destroy the anaphylactic reaction in rabbits or dogs. I have tried it in cases of allergy. It does not seem to work there. It seems to make the patients worse, but I have a patient now with vasomotor disturbance and intermittent swelling of the face and arms, who gets perfect relief, after having been afflicted for many years, from small doses of histamine.

I have another patient who is apparently getting relief from two 5 grain (0.32 Gm.) tablets of histamine phosphate a day at the beginning of attacks of migraine. The patient has had migraine for many years and has been accustomed to going to bed two or three days with nausea, vomiting and severe headache.

DR. HARRY P. SCHENCK, Philadelphia: Histamine has not been tried in these experiments. This research probably looks simple as it is presented. It is a result of twelve years of work on the chambers of the moat by a large group. This work was in part made possible by a grant from the Rockefeller Foundation, under which Dr. Abell held a fellowship.

We have been looking for fundamental things. The clumping of leukocytes, for instance, is something which I certainly never suspected in either anaphylaxis or allergy, and it does not occur in man, as we shall show later. We have tried no drugs because we are still too ignorant of what this mechanism is and what really occurs in anaphylaxis and in allergy.

Of course, we shall try to solve these other problems in time, but what would be still better would be the adoption of this technic by others, so that the research could be speeded up. It is not a one man job.

An example to show how handicapped we are, is the fact that we are still not sure which of these cells are eosinophils; yet every one asks us immediately whether the leukocytes which emigrate out into the tissue are eosinophils. We do not know, and thus far we cannot prove that they are. We are fairly certain that most of them are because of the size of granules in them, but we are still unable to prove it, and we have not even used epinephrine in any of these experiments as yet.

INFLUENCE OF SULFANILAMIDE ON INFECTED SINUSES OF RABBITS: CHEMICAL AND MICROSCOPIC STUDIES. DR. BERNARD J. MCMAHON, St. Louis.

This article was published in full in the August issue of the ARCHIVES, page 222.

DISCUSSION

DR. BURT R. SHURLY, Detroit: The problem of the therapeutic action of sulfanilamide is, I believe, one of the most important that has come before the medical profession since the discovery of antitoxin and of arsphenamine and its derivatives.

It has been used extensively in various hospitals in Detroit. Under Prof. Gordon Myers, of the Medical School at Wayne University, a considerable amount of work has been carried on.

I should like to show some slides, and I hope those who have seen them will be able to look at them again. One reason that I want to present this subject is that the Associated Press got hold of my discussion in some way, and, whereas I mentioned 100 cases of pneumonia with 6 deaths, they reported that I referred to 1,700 cases of pneumonia with 6 deaths.

Absorption from the gastrointestinal tract is complete in three to five hours in dogs, and is rapid in human beings. The drug is freely diffusible into the tissues and is excreted through the kidneys. The rate of clearance is 22.5 cc. per minute.

There are certain important prerequisites for the administration of sulfanilamide. It is now being sold over the drug counter extensively all over the country, and that practice should certainly be condemned. It cannot be used like acetylsalicylic acid. It should be administered only when the infection is amenable to sulfanilamide and there are no contraindications. Daily clinical observation for toxic symptoms and signs and frequent determinations of the hemoglobin content and leukocyte counts are necessary.

The patients should be under direct observation, because the action of the drug is rapid. Its elimination also is rapid, and the toxic symptoms can come on quickly.

The following procedures are desirable: determinations of the sulfanilamide content of the blood at the end of twenty-four and of forty-eight hours and frequent erythrocyte enumerations and different blood counts. Serious toxic manifestations are acute hemolytic anemia with jaundice or hemoglobinuria, agranulocytosis, toxic psychosis, optic neuritis and exfoliative dermatitis. There were some cases with extensive manifestations of that sort. Toxic symptoms are lassitude, malaise, headaches, dizziness, drowsiness, anorexia, nausea, vomiting, cyanosis, acidosis, fever not attributable to infection, cutaneous eruption and abrupt rise in the proportion of white blood corpuscles. Those symptoms should be watched and guarded against carefully.

Contraindications to the use of the drug are renal insufficiency and severe anemia.

Supplementary medication is contraindicated, and no other drugs are administered in conjunction with sulfanilamide except bicarbonate of soda.

Sulfanilamide is of little or no value in infections with Streptococcus viridans, Streptococcus nonhaemolyticus, Staphylococcus or viruses or in syphilis or tuberculosis.

Infections in which it has been reported to be of value include typhoid fever, actinomycosis and certain dermatologic conditions.

Infections in which it is of possible or probable value include malaria, pneumococcic infection, pneumonia, bacteremia and empyema.

Sulfanilamide is used in the following conditions affecting the eye, ear, nose or throat: otitis media due to Str. haemolyticus or Pneumococcus, mastoiditis, meningitis, septicemia, abscess of the brain, erysipelas, infections of the nose, throat or sinuses, tonsillitis, pharyngitis due to Str. haemolyticus and gonorrheal ophthalmia.

A number of patients with operative indications have been in the hospital under immediate observation; the condition was watched from hour to hour and blood counts taken. It was possible to see the infections clear up in twenty-four hours. In 1 instance, a definite case of petrositis, the patient made a perfect recovery under administration of sulfanilamide, although preparations had been made to operate and the patient had already been sent for by another hospital to be operated on the day before.

Sulfanilamide is of proved value against the following infections: hemolytic streptococcic meningitis, erysipelas, cellulitis, puerperal fever, septicemia, otitis media, tonsillitis and infection with Meningococcus, Gonococcus, Bacillus coli or Aerobacter.

In the cases at my hospital only the subcutaneous and the oral method of administration were used. The drug may be given intraspinally or by the intrapleural, the intraperitoneal or the intra-articular route.

The use of sodium carbonate, 30 to 60 grains (1.94 to 3.88 Gm.) in the initial massive dose and 10 to 15 grains (0.65 to 0.97 Gm.) in each subsequent dose, adds to the value of the drug and keeps down the acidosis.

Oral dosage is of the greatest importance, because when the condition is desperate it is desirable to give the maximum dose as quickly as possible, and the chart that has been worked out for that method of administration indicates an initial dose of 90 grains (5.83 Gm.) for each 20 pounds (9.1 Kg.) of the patient's body weight and subsequent doses of 15 grains (0.97 Gm.) for each 20 pounds (9.1 Kg.) six times daily. The use of it is continued through the night.

The action of sulfanilamide against Str. haemolyticus takes the form of bacteriostasis, alteration in the structure of the micro-organisms and increased phagocytosis by polymorphonuclears and macrophages due to reduction in the repelling substances produced by bacteria, as brought out by Dr. McMahon's experiments as well.

I present a chart of a case of pneumonia, showing a remarkable effect which the drug often has on the temperature. In my hospital diathermy, sulfanilamide in full doses and whatever serum might be indicated for the type were used in the last 100 cases of pneumonia. There were 6 deaths.

It seems to me that there should be more and more thorough investigation, scientifically, in order to understand the exact use of this remedy, because I believe it has a tremendous value, and the doses must be heroic in many cases. Before one can be perfectly sure of the bacterial examination, the damage may be done. Of course, the danger of the drug is that the toxic symptoms are not guarded against, that it is not used scientifically, that it is used generally by the public and that it is not given according to the proper indications. I think that there is much more to be learned about it but that it is the best specific for certain conditions that has appeared in a long time.

THE DIAGNOSIS AND TREATMENT OF ACUTE NASAL ACCESSORY SINUS DISEASE OF NASAL ORIGIN. DR. A. C. FURSTENBERG, Ann Arbor, Mich.

One of the outstanding achievements in the modern treatment of acute disease of the nasal accessory sinuses is the increasing consciousness of the importance of conservative therapy. An extensive experience with acute disease of the accessory sinuses in a large University Health Service leads one to give credence to the opinion that conservative measures suffice in the vast majority of cases to bring about a successful resolution of the infective process. A critical analysis of 300 consecutive cases of acute sinusitis would seem to indicate that surgical measures, even of a most conservative character, are rarely indicated. The hazards of surgical attacks on the walls of acutely infected sinuses and the risks of serious complications attending them should be again emphasized. The précis of this subject stresses the importance of a knowledge of the pathologic changes occurring in disease of the nasal accessory sinuses and the exceedingly rare indications for disturbing the natural protective mechanisms by any form of surgical intervention.

DISCUSSION

DR. HAROLD I. LILLIE, Rochester, Minn.: I, like Dr. Furstenberg, was trained by Dr. Canfield and had these same principles instilled into my philosophy of practice, and I have never had occasion to deviate from them. Patients with complications have come into the Mayo Clinic, too, after having had some of the minor surgical procedures performed for the relief of their symptoms.

The method of treating acute paranasal sinusitis is similar, except that nasal irrigation is not used. I like to give the patients some form of iodide that increases the amount of secretion, expecting that secretion hastens resolution.

Acute rhinitis in which apparently the paranasal sinuses are not involved and the infection is left to itself goes through three stages. First, the irritative congestive or dry stage, in which the sneezing and dryness is complained of; second, the stage of marked serous secretion, and third, the mucopurulent stage. When the mucopurulent stage is reached, marked relief from all subjective and objective signs occurs. It is my philosophy that if one can get a cold or an infection of this kind into the mucopurulent stage early resolution takes place rapidly.

I like to use hot wet compresses over the face and eyes, with the patient in the upright position, not lying down, or semireclining at least. I have found this procedure gives a marked degree of relief. I reserve any lavage or anything of that sort to the subacute stage, which I consider to take place after two weeks or more if resolution has not occurred. At this stage, the application of astringents to the nasal membrane, followed by moderated suction, is beneficial. If the secretion comes rapidly, it is easily removed with a cannula, not the tube that closes off the nostril, and this procedure gives relief.

There is only one condition, I think, for which surgical intervention is justifiable, and that is an acute fulminating condition of the frontal sinuses, and I deprecate any effort to go through the region of the nasal frontal duct. It is my opinion that an external trephination is much less hazardous in such a condition than the intranasal operation going through the vascular and glandular system near the cribriform plate. It has been performed on several occasions in my experience, and it has given wonderful and quick relief without complication. In the type of disease of the paranasal sinuses that is caused by swimming, the relief is great and the danger much less, in my opinion, than that of going through the region of the nasal frontal duct.

Dr. Thomas E. Carmody, Denver: I remember a case in which I opened up the sinuses about twenty years ago. I did a lavage of the antrum in a case of streptococcic infection, and the patient died. It taught me a good lesson. In talking with a number of my friends, I found they had had the same results. It is also known that the general surgeon has had that result in operating for acute conditions of the tubes and acute infections generally. They should be let alone.

The treatments that Dr. Furstenberg and Dr. Lillie outline are all good. I do not use ephedrine; I use epinine (dihydroxyphenylethylmethylamine) instead, 1 to 800, and I feel that it is much better. I do not use the Proetz method, although I use a modification of it, having the patient lean forward, because he can apply the drug much more easily. If he leans forward far enough so that the top of his head is parallel to the floor, he can drop the solution in and contract the tissues.

I do not believe in packing with mild protein silver and similar preparations, because I believe that one excoriates the membrane much more than is necessary. I do not use the saline irrigation that Dr. Furstenberg has recommended, although I think it can be used under the circumstances that he speaks of, but it is too likely to be used by persons who do not understand it and is sometimes used for children.

I have for many years used only the inhalation of steam. A great many persons, of course, like to add benzoin steam or something else, and sometimes there is no objection to adding something to steam, because it only gives the odor in the air. The main thing is to have a great amount of moisture in the air and to give the patients a great deal of water in one way or another and sometimes of course to give them saline solution by intravenous injection in order to have a large amount of secretion.

I am not familiar with the experiment Dr. Furstenberg has outlined, but I think there is no question but that it may be helpful.

I have always been against probing the nasal frontal duct, because I have seen some bad results from this. I have had 3 or 4 cases such as Dr. Lillie has spoken of, in 1 of which the condition followed swimming, and opening simply by trephining has relieved the symptoms. There have been, of course, many patients with ethmoid infection who have died after operation, but if a small opening is

made with a trephine in order to relieve the infection, relieve the pressure and prevent the spread of infection in the other direction some of these patients may be benefited.

Dr. George B. Wood, Philadelphia: I agree with Dr. Furstenberg absolutely in everything he has said, but I still meet with a certain condition that to me is extremely puzzling and serious, and that is fulminating streptococcic frontal sinusitis.

Years ago, I had a nurse at the Howard Hospital who after swimming in a pool in the city had ordinary acute sinusitis. I saw her three days later. Her eye was swollen and almost shut. For four days she was treated conservatively, until her temperature was 104 F. I did not know what to do, but something had to be done. I trephined through the outer wall of the frontal sinus. There was pus coming out under the periosteum before I operated. She died of abscess of the brain three months later.

About a year and a half ago, I observed a similar condition in a nurse at the Graduate Hospital. I talked to Dr. Coates, and he agreed that I should do as little operative work as possible to get drainage to the frontal sinus. I made a small opening with a trephine through the floor of the frontal sinus. Osteomyelitis with abscess of the brain developed and the patient died.

I wish somebody would tell me what to do in such cases.

Dr. Arthur W. Proetz, St. Louis: I am practically in complete accord with everything Dr. Furstenberg has said, and I should not be speaking at all if it were not that I want to ask Dr. Furstenberg a question, and I also want to say that I do not agree with him as to the irrigation of acute infections in the most acute stages. After the purulent stage is reached, when the organism has adapted itself to the situation the problem is a little different. Whether the physician brings about the purulent stage, which is much more advantageous for the patient than the early stage, or whether the purulence is a result of the fact that the patient has already taken care of himself is neither here nor there, but I find that irrigation in the early stage usually does little good and does harm so often that I have abandoned it altogether. I do not think I have punctured an antrum in the last two years for any reason.

I should like to ask Dr. Furstenberg to elucidate a little further the experiments with the mucin and the bacteria. As I understood it, bacteria penetrated more easily when injected under the skin or under the peritoneum, but I wonder what the situation is when they are embedded in mucin and then applied to the nose. It seems a little incongruous that bacteria mixed with mucin should be virulent as bacteria are 3 per cent mucin. When the original mucin is washed away, it is not gotten rid of. In three minutes it is back again. The mucin content has direct influence on the viscosity of the secretion. As long as the viscosity of the secretion is normal or is workable, let me say, there is a great protective blanket. As soon as the viscosity becomes a little greater so that the mucin can tug the mucous blanket along or there is not enough tenacity to keep it going, then there is interference with that normal machinery which nature has set up to take away the surplus infection. That is one of the reasons I do not use irrigation, because it does upset that tough blanket for long enough to cause invasion, and I should like to know about mucin on the surface.

Dr. Henry L. Swain, New Haven, Conn.: It is good to have some one who has the courage of his convictions coming before this distinguished body and speaking in a conservative way as Dr. Furstenberg has. One must consider, however, the environment in which his work lies, with a university group, in a delightful village with buildings molded after New England structures. Treatment of diseases of the sinuses among the people of that group and among the people from the Stock Yards of Chicago or among the dock hands of Boston and New York is vastly different. One cannot expect to govern the different practices by the same rules. However, the general principles involved are tremendously

important. Dr. Proetz comes before us. I wish all could see the active ciliated, the living ciliated epithelium working as he has showed it at one of his demonstrations, that beautiful, soft wave of ciliated action that he shows in the trachea or nose of the rabbit or calf.

It gives me positive pain to see some physicians in various clinics work in the nose. They wad up a ball of cotton on an applicator and shove it down through the nostril just as though they were punching dirt into a posthole. Every time the ball of cotton goes through it knocks off ciliated epithelium. What protects the area except ciliated epithelium and the layer of mucus that lies over it?

Dr. Burt R. Shurly, Detroit: I wanted just one word, lest the departed fellows of this association, such as Dr. Stucky, should be forgotten. I trust that when dealing with acute inflammation in the nose the younger generation will not forget that a good dose of mild mercurous chloride and a fine dose of salts are great things for the lymphatic system.

Dr. Robert F. Ridpath, Philadelphia: I think that the acute sinusitis must be differentiated from the subacute and, of course, from the chronic. If one speaks of the acute infections of the sinuses, is one speaking of an acute infection of the sinuses themselves or of the ordinary coryza, or cold? All colds, of course, as they are understood, are potential infections of the sinuses, because the mucous membrane of the sinus is going through the same pathologic condition or infection as occurs in the nasal membrane.

I should like to ask Dr. Furstenberg whether roentgen therapy is of any value in the acute stage of an infection of the sinuses. Second, does he apply infra-red rays to the face, the sinuses or the back of the neck at this time? Third, were not the grandmothers and the mothers of this generation wise in trying to bring congestion from the upper part of the respiratory tract or from the head by keeping heat to the feet or to the extremities of the body in all cases of acute congestion?

Dr. A. C. Furstenberg, Ann Arbor, Mich.: Dr. Lillie has spoken about the nasal irrigation, and I remember at one time he questioned its value in infections of the upper part of the respiratory tract. I must add, too, that up to the present time I have not advocated nasal irrigation. I have mentioned the possible effect of salt solution on accumulated mucin in the nose, but I have had no experience with nasal irrigation in treating acute disease of the accessory sinuses.

Dr. Wood has spoken about fulminating frontal sinusitis. That term suggests to me infection of the frontal sinus associated with congestion and swelling over the sinus and perhaps a good deal of redness and hyperemia of the eye. Is such a condition not due to a rupture of the osseous wall of the frontal sinus and the production of an inflammatory process in the soft tissue? If it is the result of such a pathologic change, is it not possible to drain the abscess merely by an incision in the soft tissue? Avoid bone work, if it is possible to do so. Avoid anything that will stir up an infection in bone. I know it has been my experience that the patients have gotten along nicely after mere drainage of the soft tissue. Wait several weeks, and much to one's surprise and gratification, many of the persons will get well spontaneously. Others will require, of course, more radical procedures later.

Dr. Proetz asked about the experimental work involving mucin. I have seen much of this in progress, but the one picture that was more dramatic than any other was as follows: Rats were placed in a box containing just normal air and pneumococci were sprayed into the box. Fourteen such animals were employed. Pneumonia did not develop in any of them. When, however, pneumococci were sprayed into that box in the presence of mucin, pneumonia developed in all the rats. This experiment has been done repeatedly, and the observations, I believe, would convince one that mucin has something to do with increasing the virulence of infection. Whether it is cohesive action, phagocytic action or what not, I am not prepared to say, but I think most bacteriologists will agree at the present time that the mucin does increase the virulence of the infection.

Dr. Ridpath asked about the value of roentgen rays in the treatment of acute disease of the nasal sinuses. Some little experience for about two years convinces me that they have little or no value. I have used infra-red rays occasionally, merely for the application of heat, as something that would take the place of the hot water bottle or the electric pad, but I have had considerable experience with roentgen treatments of acute disease of the nasal accessory sinuses, and the results thus far have been discouraging.

CHORDOMA WITH REPORT OF TWO CASES. DR. ROBERT F. RIDPATH, Philadelphia.

Chordoma is a rare and unusually fatal tumor which arises from the fetal notochord. This structure consists of a cord of cells around which the vertebral column develops and regularly persists in infants in the centers of the intervertebral disks, portions of the tissue of the chorda commonly remaining at the base of the skull and in the coccyx. This tissue gives origin to certain small tumors which Virchow describes as "ecchordosis spheno-occipitalis."

Chordomas have been classified as (1) cranial, (2) vertebral and (3) sacrococcygeal. They have been reported as occurring in various locations in the following order of frequency: in the sacrococcygeal region in 91 cases, in the spheno-occipital region in 52 cases, in the cervical portion of the spine in 12 cases and in other locations rarely.

DISCUSSION

MR. GAVIN LIVINGSTONE, London, England: I wish I could have heard this paper three years ago, because at Middlesex Hospital Mr. Simonson had a case of this type. I should like to demonstrate the following slide, for it shows part of the vestigial remnants which are presenting.

The cells are of the type associated with nucleus pulposus. The notochord is schematic. The places where the notochord persists have already been explained, but here is the most common place, just at the base of the sphenoid, and the tumors can be classified into two types. I am talking of both the sacral and the cervical tumors. One is the malignant type, in which the mucin-producing cell predominates and on histologic examination there are a lot of hemorrhages in all stages of development. These tumors do not metastasize, but they invade, and in the case at Middlesex the tumor invaded the base of the skull and was pressing on the brain, but it did not actually invade the brain.

The tumor also responded to radium rather remarkably, and the part in the nasopharyngeal space disappeared entirely; at autopsy, about a year later, the tumor was the size of a golf ball inside the skull, but microscopically and histologically the postnasal space was clear. The bone of the nasal sphenoid also was involved, but it was not until last month that the roentgenograms showed the tumor invading the bone.

DR. ROBERT RIDPATH, Philadelphia: One thing that Mr. Livingstone mentioned is characteristic, which I tried to point out, and that is that there are no metastases. Glandular involvement is nil in all chordomas. There is extension, proliferation into the tissues, but the glandular material is not involved, and these are the diagnostic differences between chordoma and any of the other tumors that are in this particular neighborhood.

OSTEOMYELITIS OF THE FRONTAL BONE: REPORT OF EIGHT CASES. DR. RICHMOND MCKINNEY, Memphis, Tenn.

This article was published in full in the July issue of the ARCHIVES, page 10.

DISCUSSION

MR. VICTOR E. NEGUS, London, England: I am glad to have the opportunity of speaking on this subject, not because I have anything different to say from what has been said already, but rather to add what evidence I can to the con-

clusions already reached not only in the paper read this morning on established osteomyelitis but also in the paper read yesterday on the treatment of acute sinusitis.

At the beginning of the time when I was working at King's College, which is where I spent my medical life, the surgeons there had rather violent and drastic methods of dealing with these conditions, thinking that they had to get ahead of the disease in cases of acute involvement of the frontal sinus, and the results were really disastrous.

In a short time the principles of delay were established as they had been in the treatment of acute mastoiditis in our practice, and now we have come to conclusions similar to those expressed yesterday and today, the conclusions being that in the treatment of acute sinusitis there should be the greatest conservatism but when there is established osteomyelitis there should be drastic treatment.

We have had a considerable number of cases of involvement of the sinuses, all the sinuses, and if the patient comes to us in this condition, with swelling, even with the eye completely closed, the treatment is conservative.

Mr. Bateman collected these cases ten years ago, and we have a series of cases in which there is not only involvement of a maxillary sinus but involvement of the frontal sinus and many such cases with a collection of pus.

In England, it is still necessary to point these things out because, unfortunately, there are some surgeons not well informed, who would feel it their duty to operate on the frontal sinus in a case like that.

In my practice, the frontal sinus would never be touched, and the principles are similar to those expressed yesterday.

The question of lavage of the maxillary sinus is one that one needs to go into, but the frontal sinus itself will not be touched, and my experience has been that, as a result, complications in the bone, complications of osteomyelitis, complications in the frontal lobe, abscess, meningitis and sinus thrombosis have almost disappeared. The cases that are on record have been ones in which the complications followed operation.

Now conservative treatment, I think, has almost eliminated these complications, and I feel firmly convinced, from reports and from my own experience, that the complication of osteomyelitis is usually secondary to operation, more often to precipitate operation on the frontal sinus, possibly without any traumatic damage to the frontal sinus, and I have recently, in the last few months, seen 2 cases with unfortunate developments, in which osteomyelitis has followed operations on the antrum. They were not cases of my own, but I was asked to see the patients in consultation, and so far as one could gather there had been no reason for disaster.

An intranasal antrotomy had been performed and in 1 case an operation on the ethmoid cells, but in place of these a puffy swelling appeared over the frontal region, and it has been proved to indicate involvement of the cryptolithic bone which spread. As was described today and has been seen in many cases, the sickness seemed practically afebrile in its course, but with the creeping osteomyelitis. Even the most extensive operation, though it has extended beyond the area of involved bone, has failed to prevent secondary infection of the frontal lobe. Both those patients died.

I do not know whether it is a common experience. I merely mention these cases as being the only 2 I can recall in many years, and I would reiterate that our principles are identical, I think, with those expressed, to employ the greatest conservatism in cases of acute involvement and only when there is established osteomyelitis to undertake extensive removal of bone, but I have not had as fortunate results in these cases as I have heard described today. The results were not satisfactory.

Dr. George M. Coates, Philadelphia: My experience does not coincide with the previous speaker's or entirely with Dr. Furstenberg's as described in his talk of yesterday. In the last three or four years, I have seen a good many of these

cases of osteomyelitis, and in all of them I think Dr. S. R. Skillern has been associated with me in the care of the patients.

Of all the attacks that I have seen in the last ten years or more, not more than 2 or 3 have followed any surgical trauma. One, two or three years ago, followed a puncture of the antrum with a needle in a case of acute involvement brought on by swimming, and after some days the anterior portion of the middle turbinate was removed. In practically all the other cases the condition has not followed acute thrombosinusitis treated by surgical measures, though 1 mild attack did follow drainage of the frontal sinus through the floor.

I have seen the frontal sinus drained externally in cases of acute involvement and in cases of chronic involvement over a long period of years, and I have never seen, with that 1 exception, osteomyelitis follow surgical intervention on the frontal sinus.

Do not misunderstand me. I am not advocating radical treatment of acute involvement of the frontal sinus, but when the patient has osteitis of the frontal sinus with swelling, closing of the eye and exophthalmos, I believe one is justified in doing an external operation.

In the cases I have seen, particularly recently, in which a conservative course has been followed, I have finally had to open the frontal sinus because of osteomyelitis and occasionally have found an abscess of the frontal lobe.

As to the treatment of osteomyelitis after it has developed, I have felt for a long time, following the work of Mosher and Judd, that wide, ruthless eradication of the diseased bone is absolutely necessary. I have seen conservative treatment applied, and I have possibly seen 1 or 2 of the patients get well by sequestration, sequestrums being removed later, but I have seen so many of these cases in which intracranial complications developed, meaning an abscess of the frontal lobe particularly, that I am no longer in favor of conservative treatment once the osteomyelitis has developed.

I furthermore believe that the method of removal should be from good bone down and not from bad bone up, a wide, ruthless removal of the bony plate being made, in one piece if possible.

There is a difference between osteomyelitis and osteitis. There is not always diploic bone in the anterior wall of the frontal sinus. If there is no diploic bone, the pathologic condition, as I understand it, is going to be osteitis, and this, if not removed in time, will spread up to the juncture of the two tables and the internal and the external wall, where the diploic bone is more likely to commence. Once it gets there, there is a development of osteomyelitis of the frontal bone, and I think that the only safe method is to remove it and remove it widely.

Dr. Samuel H. Skillern, Philadelphia: Since September, Dr. Coates and I have had 5 cases of osteomyelitis, in all of which the condition was complicated by abscess of the brain. We have been doing, as Dr. Coates said, the wide extirpation, starting with a superciliary incision, and we have tried to minimize the scarring that is seen in the pictures by making the incision starting at the outer confines of the eyebrows and coming down and after a little dip coming up over the outer eyebrow.

Granting that this is the hair line and one comes down to the temples, the incision is carried on backward above the temporal fossa into the hair. In that way, all of this scarring in the front is eliminated. There are two small scars on the sides, which if closed properly are soon obliterated.

In order to regenerate bone, recently we have been using bone chips on the dura at the first dressing.

Dr. A. C. Furstenberg, Ann Arbor, Mich.: It is a rather interesting observation to me that of 58 cases of osteomyelitis of the skull in 42 the condition has followed some surgical intervention for acute disease of the nasal accessory sinuses, and in 4 instances, a devastating attack on the calvarium was observed after the simple intranasal drainage of an acute infection of the maxil-

lary sinus, so that I think it will be admitted that this is a dreadful surgical tragedy, and one cannot help wondering if it is not in some way due to some error of omission or of commission on the part of the otolaryngologist.

I am particularly interested in the method of spread of infection in osteomyelitis of the skull, because I think this method of spread has much to do with the principles of treatment. In many instances, the spread is by continuity of tissue; that is, the infection simply passes directly from the frontal sinus into the diploe of the skull between the external and the internal table of the skull. In other cases, however, the spread is chargeable to an intercranial yet extradural infection.

I think one can demonstrate with ease that in many of these cases the condition is thrombophlebitis of the vessels of the mucous membrane of the frontal sinus, and since those vessels communicate with the meningeal vessels the infection extends back through those vessels onto the dura and there an exudate develops between the inner table of the skull and the meninges that will spread over the dura and cause destruction of the inner table of the calvarium and then of the diploe and later of the exterior table. In many cases the internal table has been first destroyed, later the diploe and then the external table.

If that observation is correct—and I think it is perfectly possible to produce microscopic studies which are convincing—then it seems necessary, I believe, to remove in a radical fashion the full thickness of the involved bone if one entertains the hope of curing persons with extensive osteomyelitis of the skull.

Then, too, I have been interested for some time in the reparative process in cases of osteomyelitis of the skull. In all of my cases, there has been regeneration of bone, rather extensive regeneration of bone. In 2 cases the entire calvarium has been removed and, surprisingly, within six months to two years, the whole calvarium has been restored through the medium of regenerated bone.

I think it can be demonstrated that bone will regenerate or will grow from any background of fibrous connective tissue which contains bone and which is irritated by a little infection. If periosteum is stripped free of bone, it will not regenerate bone; adding a little bone dust or some bone shavings to periosteum and then irritating the wound with a little infection will cause regeneration to occur rapidly. Into this discussion I should like to inject this observation, that the dura is an active osteogenetic membrane. Bone will regenerate from the external layer of the dura. The external layer of the dura is a periosteal element, and if one adds a little bone dust to the dura and irritates it with a little infection regeneration becomes active.

I repeat again that I am in possession of roentgen studies of 58 patients, which will demonstrate most extensive reparative processes in osteomyelitic lesions of the skull. Consequently, I think one needs have no apprehension in removing wide areas of bone in these cases, and I believe the only hope of successful treatment lies in doing what Dr. Coates, Dr. McKinney and others have recommended, namely, a wide removal of all of the infected bone, including the full thickness of the calvarium.

Dr. Frederick T. Hill, Waterville, Me.: From the study of Dr. Mosher's series of roentgenograms made in cases of osteomyelitis one is impressed with the appearance of diploic veins and with the possibility of extension of the inflammation from them.

Dr. Fletcher D. Woodward, Charlottesville, Va.: The most important thing of all in this consideration of osteomyelitis apparently has been overlooked. I refer to the bacteriologic aspect of it. The most common bacterium found is the staphylococcus.

Practically all of the patients have a low blood titer to the staphylococcus. If they have a low blood titer, it can be raised by giving toxoids, and if one can raise the titer one has done something to help.

Regarding the question of transfusions, there is another element along specific lines. Among the available donors there are some who will have a much higher titer against the staphylococcic toxin than some others. The blood of the donor who has the highest titer is used for transfusions.

Mr. Victor E. Negus, London, England: If I might be allowed to make one correction to avoid any misapprehension, I should like to make it clear that the 2 cases I mentioned of osteomyelitis of the frontal bone following operations on the maxillary sinus were managed by two colleagues who had the same views as I. The operations were performed in cases of chronic sinusitis and not in cases of acute sinusitis.

Dr. John F. Barnhill, Miami, Fla.: I have had the decided feeling that the way to stimulate the process under discussion is by probing around the frontal sinus in acute conditions.

Just a word about operation for osteomyelitis. I think operation ought to be done in all cases. It depends entirely on the judgment of the man who does the work or of his consultants, but there is a time when the consultants and the operator should operate and operate thoroughly.

I agree, therefore, with Dr. Coates' method of removing wide areas, and by "wide areas" I mean all the disease. It is not of any value to take away any part of the diseased bone unless one takes it all away. The skull has no function except as a protection. One can live without a skull perfectly well, provided the interior that it encloses is protected.

How is one going to know when one gets it away? I think that is the most difficult problem confronting the surgeon. Roentgenograms do not show it exactly. If one follows them to the letter, one will miss it sometimes widely, and so there are few ways of knowing.

I am convinced that any surgeon—and no doubt others here have had this experience—can learn to detect by finger and by the eye when he has gotten enough bone, but, in addition to that, the thing that is most valuable to me is the sound of the instruments that cut through the bone, and therefore the ears play a part. Every one can tell by the sound of the chisel and by the ring of the rongeur exactly whether the bone is healthy or not. The bone, of course, is softer in the osteomyelitic parts, and as long as it is soft, as long as there is little resistance to the hand when I am biting and as long as the ring of the chisel is not correct while I am chipping, then my rule is to continue absolutely until these conditions satisfy me, and I do not know whether it is accident or not, but I have not had a death from osteomyelitis.

Dr. Joseph C. Beck, Chicago: I missed any reference made to complications to the operation—extensive removal of bone. I happened to have 1 patient in a few of the cases in which operation was performed who was extensively operated on, a boy in whom epilepsy had developed, and in this connection I am prompted to ask Dr. Furstenberg whether he has ever reoperated in any of the cases to see whether there was any regeneration of bone.

In this connection the chairman said that the skull is only to protect. Its absence also may make trouble, as in some of the cases in which epilepsy will develop.

Fascial transplants may present adhesions of the denuded part and thus prevent epileptiform seizures.

Dr. Richmond McKinney, Memphis, Tenn.: The important question is whether osteomyelitis follows operations on sinuses or not, and there seems to be an even division regarding this.

Dr. A. C. Furstenberg, Ann Arbor, Mich.: I can merely quote some more statistics by saying, Dr. Beck, that in the series of cases of osteomyelitis of the skull there was 1 patient who returned with epilepsy. He was a boy 16 years of age, who had had an abscess of the frontal lobe with osteomyelitis. The abscess was drained successfully, and this boy made a recovery and returned two

years later with jacksonian epilepsy. The brain surgeon opened the wound. I took some bone for microscopic study. It is embryonic bone, but passes through all the evolutionary stages of the development of bone. The scar tissue in his brain was removed, and the boy has recovered without further epileptic attacks. This was one year ago.

OBJECTIVE EVIDENCE OF IRRITATION OF THE THROAT FROM THE HYGROSCOPIC AGENT IN CIGARET SMOKE. DR. H. C. BALLENGER, Chicago.

This article will be published in full in a later issue of the ARCHIVES.

DISCUSSION

DR. ARTHUR W. PROETZ, St. Louis: It was found when this study was begun that there were many variables. Irritability depends on many things: how fast the cigaret is smoked; how wet it is; what position it is held in; how it is being smoked, puffed quickly or puffed slowly; how long one holds the smoke in the mouth or lung, and many other things. Just to show how these vary, I will pass around some mounted specimens. These represent the deposits, the sedimentation of cigaret smoke on a piece of moistened gelatinized paper. They show the variations in the deposit of tar one can get if the cigaret is held onto the paper five, seven, seven and a half or ten minutes. The results depend on whether or not the cigaret is allowed to burn through before the last puff is taken and the sedimentation test administered—I should not say "sedimentation," for it is simply the settling of smoke—or whether one bases his estimation on the first puff, middle puff or last puff. Some persons smoke a cigaret to about an inch (2.5 cm.) and then throw it away; some people smoke it to their fingers. It makes all the difference in the world. I bring this in to show what tremendous error can creep into observations and what a necessity exists for standardization of methods.

DR. WILLIAM B. CHAMBERLAIN, Cleveland: The reports that have been rather prevalent of late of so-called tobacco angina are interesting, as are those of gangrene of the extremities induced by obliterating endarteritis in inveterate cigaret smokers.

DR. D. C. JARVIS, Barre, Vt.: Nearly ten years ago, the Department of Industrial Hygiene of the United States Public Health Service came to Barre to study inhalation of silica dust. The personnel included a full time physician, who stayed two years and a half, and a dust count engineer, who stayed over a year. In due course of time, the dust count engineer came to the office complaining of cough, which he explained had appeared since coming to Barre. I thought his cough was due to the dusty environment of the granite sheds where he worked and told him that when his respiratory tract became adapted to this environment the cough would disappear, as it generally does with apprentices who come to the industry; but he told me his time in the shed included only the gathering of samples of dust and all the rest of his work was done outside. I asked him if he had done any work or heard of any work done on cigaret dust count. He said he did not know of any work of that kind, and later, because he was an inveterate smoker, I asked him if he would do this. He returned after a few days and informed me that he had done some work on himself and his friends at varied puffs and he could safely say each time one inhales from a cigaret one takes in 120,000 particles of dust 10 microns or under in size; apparently then the problem was one of mild inhalation of dust, which might overload the lymphatics and bring about cough.

It was decided to apply the principle of a wet filter, and after discussion this was applied by moistering the mouth end of the cigaret with saliva for about ¼ inch (0.6 cm.) before lighting and starting to smoke it. Dust counts made subsequently showed that he controlled the greater part of the dust in this way and developed a cool smoke, and his cigaret cough disappeared within two weeks.

Since that time, when persons I know to be smokers of cigarets have presented the symptom of cough, I have suggested that they moisten the cigaret for ¼ inch (0.6 cm.) to cut down the dust and produce a cooler smoke, and in the majority of cases this procedure results in the disappearance of a cough within two weeks. If the cough does not markedly diminish in two weeks' time, one looks elsewhere for the source of the cough.

Dr. Harris Vail, Cincinnati: I think one thing has not been mentioned so far in the discussions, and that is that the posterior sinuses of the nose may be an important factor in the symptoms which the smokers have. I believe that if one would study an equal series of nonsmokers with the same amount of health in the sinuses one would find about the same results as are found in the case of the smokers. There is no doubt that many of the symptoms of postnasal irritation and pharyngeal irritation come from posterior sinusitis, and I should like to ask Dr. Ballenger if he has examined carefully the sinuses of the subjects he was studying in his experiments.

Dr. Samuel Salinger, Chicago: I am a cigar smoker and as such have assumed a more or less tolerant attitude toward the finely chopped spinach, which has to be treated with hygroscopic agents and then wrapped in paper and which is commonly called cigarets; however, I am not prejudiced on that account. I had the pleasure of participating in this test with Dr. Ballenger, and one of my first conclusions was the absolute worthlessness of subjective sensation. That was proved to me conclusively by one fact. Two of my subjects were physicians who had been in the habit of smoking one particular brand of cigarets, which I do not care to mention.

Their subjective reactions to nos. 1, 2 and 3 were that they were vile, viler and vilest, and they could scarcely wait for the day when they could go back to their favorite cigaret. They returned to that for the fifth week and after smoking it for several days had to give it up and adopt some other cigaret, proving conclusively how much psychology enters into the enjoyment of a cigaret. Objectively, my findings were practically those that Dr. Ballenger detailed. I could not find the slightest difference in the local reaction which they caused between 1 and 2 or 2 and 3. It has always been my impression that such local findings as I was able to determine were based more on the quantity of tobacco consumed than on the relative quality of it.

I differ slightly with Dr. Ballenger when he makes the statement he has never been able to detect a smoker's throat. I have had occasion many a time to have a patient under examination who displayed such a violent redness of the soft palate and the fossae that I was prompted to ask whether he had a sore throat; much to my surprise, the patient would reply, "No," and say that he was not conscious of any subjective symptoms.

Dr. M. G. Mulinos, New York: It is presumption on my part to discuss a clinical paper; I am a pharmacologist. However, since I was quoted and partly misquoted, I think I should straighten out some of the points made.

First of all, my associates and I at Columbia worked on rabbits' eyes, not on the nose and throat. The smoke was not passed over the eye but made into a solution. The "smoker" was invented for the purpose, and we measured edema, not redness, because, in the mucous membrane of the eye at least, as soon as we got what we called 1 plus inflammation, the blood vessels would be shut by the edema and the mucous membrane would be paler than normal; consequently, redness was worthless as an indicator.

So far as the irritation's being due to temperature is concerned, I know one cigaret company claims that their smokes, because of menthol, are actually cooler than any other. We have made over a thousand observations on cigaret smoke emerging from the mouth end of the cigaret and found that until the cigaret, the burning cigaret, actually touched the thermocouple there was absolutely no difference in the temperature of the smoke or air emerging from the mouth end

of the cigaret, the mouth end in this case, of course, being the pipe holder; and, therefore, there is probably nothing to the contention that a cigaret smoke is warmer than any other smoke or cooler.

The last speaker said something about smoking cigars. I do not smoke anything at all. He smokes cigars. It so happens that cigars do have hygroscopic agents, and, therefore, they are just as much doctored up as cigarets.

One other point was that our work at Columbia was substantiated by a double number of experiments performed by Dr. Wallace at New York University, whose paper was not quoted. The work of Sparlit that was quoted was based merely on a personal opinion, without any figures. The work of Dr. Carlson, at Chicago, was based on the amount of saliva secreted, and that is an unreliable basis, because all I have to do is think of cigaret smoke and I salivate, probably protectively; and I suppose that most persons who smoke a great deal salivate in anticipation—consequently, that basis must be rejected.

The only paper that remains in comparison with our objective experiments is that of Haag, who performed only a small number of experiments and may or may not have been able to repeat our experiments. We are willing to grant his experiments were against ours. The point remains that only his paper was against the view that when hygroscopic agents are added to a cigaret, it depends on the chemical nature of the hygroscopic agent whether the smoke is more or less irritating, and we might say whether the smoke is more or less unpleasant. The point was that both cigarets, or all three cigarets, two containing hygroscopic agents and one not, were irritating, and because both Wallace and we performed hundreds of experiments and treated the data statistically we were able to find a slight difference between the two.

Whether the patient smoking for years, not a week or two, can accumulate this irritation so as to present clinical evidence of it, as shown by the second speaker, is a question for clinicians to settle. Such evidence is immeasurable, and the question cannot be answered in the laboratory.

DR. H. C. BALLENGER, Chicago: I fully agree with Dr. Proetz in his statement that the clinical investigations perhaps are not of much value under any circumstances. Certainly any that have been done to date, including my own, would not justify any definite conclusions whatsoever, and I hope, Dr. Proetz (and I am sure he will) will develop a little more precise method of making clinical examination. I think the laboratory work is perhaps of more value; on the other hand, the impressive reports, that is clinical reports, which have been made, I think, are valueless to date.

Undoubtedly, Dr. Vail's comment that the postnasal discharge is from a sinus rather than from smoking is true, and I fully agree with him in that respect; however, the symptoms were put down as the patients gave them, and most of them attributed this condition to smoking.

I personally agree with Dr. Salinger. He is one of the men who did the work, and his results were the same as mine.

Dr. Mulinos is quoted correctly in the paper. Because of my faulty delivery, his work was grouped with the work of Flinn. Flinn's work was clinical, Mulinos' was done in the laboratory, and in the clinical paper I go into detail on the work of Mulinos and describe the effect on the sac and the edema. Rather than repeat that in detail, I unfortunately mentioned the work only in connection with that of Flinn.

Book Reviews

Diseases of the Nose, Throat and Ear; Medical and Surgical. By William Lincoln Ballenger, M.D., F.A.C.S., and Howard Charles Ballenger, M.D., F.A.C.S. Seventh edition, thoroughly revised. Price, $11. Pp. 1030, with 576 engravings and 30 colored plates. Philadelphia: Lea & Febiger, 1938.

This standard textbook has now reached a seventh edition. It has been thoroughly revised and partially rewritten, so that any new material added in the appropriate sections would simplify the study of the subjects. Thus a separate chapter has been devoted to benign neoplasms of the nose, throat and larynx, whereas in previous editions the subject of benign neoplasms was described under various regional subheads, with much necessary repetition of some portions. In like manner the subject of malignant neoplasms of the larynx, throat and nose has been combined in one chapter and much detail thus condensed and simplified.

The subject of sinusitis, always so important and treated so thoroughly in former editions, has been enlarged to include a definite consideration of the individual sinuses and sinusitis in infants and children, as well as sinusitis in general. This helps to correlate the various entities described.

The general plan of the distinguished senior author has been retained, to the end that the text preserves that indefinable balance noted in the former editions. Though it has become necessary to eliminate obsolete material, it is to the credit of the junior author that fundamentals and well grounded principles and procedures have been retained.

Chapters on peroral endoscopy and gastroscopy, as well as those on the physiology and functional testing of the labyrinth and the indications for operation on the labyrinth, have been revised and these subjects brought down to date. Dr. J. M. West has described his intranasal operation for dacryostenosis and has discussed the subject in general.

The text is well written and contains numerous diagrams, schemata, engravings and plates, which enhance the value of the instruction. The entire theme is based on a broad clinical point of view, and all references to the anatomy and physiology of the parts under consideration incline to this policy. As in previous editions, therapy by drugs is given due attention. This is as it should be, for many desirable dynamic effects can be elicited by judicious use of drugs, and to fail to make good use of this important aid means to deprive one's patients of some available help. Treatment other than by drugs is painstakingly outlined, and all procedures, medical or surgical, are lucidly described.

The important subject of deformities of the nasal septum and their surgical correction is classically presented. Thrombosis is concisely described and many problems clarified. The chapter on the singing voice is deserving of the utmost praise; indeed a vast amount of valuable information is given in this section, which throws new light on the respiratory efficiency, the control of the expiratory air current and the relationship of the mechanics of the chest and abdomen to the richness, quality and power of the voice.

It is humanly impossible to evaluate the numerous other good points of this octavo of 1,030 pages adequately in a comprehensive review. Again and again one finds good common sense in certain diagnostic and therapeutic opinions demonstrated.

This book should be in the library of every otolaryngologist and will be of great aid, as a text and a reference book, to the medical student, the graduate student in otolaryngology, the oculist and the resident in otolaryngology and ophthalmology.

Practical Otology. By MORRIS LEVINE, M.D., F.A.C.S. Second edition, thoroughly revised. Price, $5.50. Pp. 416, with 146 engravings and 3 colored plates. Philadelphia: Lea & Febiger, 1938.

The book is excellent, concise and valuable for both the undergraduate and the general practitioner. It is well constructed and written in an extremely easy, clear-cut style. Since the aim of the author was to correlate his series of lectures, he has been most successful, in that the subject matter is well condensed and one experiences no difficulty in reaching the point under discussion. However, it is for this reason that this book may fall short of the expectations of the otologist, since only limited discussion is given and casual mention made of many important and mooted problems.

In the chapters dealing with the laboratory findings, it is felt that greater stress should be laid on the significance of these examinations. Some references should have been made to the value of the Schilling hemogram, the sedimentation rate and the changes in the blood, such as nuclear degeneration or alteration of the degenerative index, in the course of infection.

The subject of treatment has been given serious consideration, and the many suggestions, as outlined, indicate a knowledge not only of otology but also of the influences on the field of otology of the general conditions allied to those of the ear. While there may be some individual differences in the use of the various medicaments or prescriptions, those recommended are stable and have withstood the test of time. Here, too, more emphasis might have been placed on the value of some of the newer preparations, particularly of sulfanilamide.

The operative procedures are well described, with a great deal of attention to detail. The chapters dealing with them are extremely lucid, and there is no difficulty in following the technic.

Throughout the book, reference is made to the most recent advances, from the standpoint of both academic discussion and practical application. The photographs are good and well illustrate the point under discussion. The paper and printing are excellent and lend themselves to make this a book for ready and rapid reference.

Method of Examining the Larynx by Means of the Roentgen Ray. By RICHARD WALDAPFEL, Assistant in Ear, Nose and Throat Division of the General Polyclinic Hospital, Vienna. Pp. 91, with 77 illustrations. Leipzig: Georg Thieme, 1938.

The author's purpose in writing this monograph was twofold. He wanted to convince laryngologists of the value of a roentgen examination in cases of disease of the larynx and to present to the roentgenologist in a concise and usable form the various methods employed in the study of the larynx by means of roentgen rays. He has achieved his aim in both respects.

The author stresses the need of a thorough grounding in the anatomy of the parts and a familiarity with the clinical appearance of various lesions. There is a section on ossification of the laryngeal cartilages, following which pathologic changes in the individual component parts of the larynx are discussed and illustrated.

A novel method of demonstrating lesions of the larynx in the anteroposterior view without superposition of the cervical portion of the spine is presented. It is accomplished by inserting small films in the hypopharynx after local anesthesia.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Prof. H. Burger, Keizergracht 317 C, Amsterdam, Netherlands.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg 143, Groningen, Netherlands.

Hungarian Otolaryngological Society

President: Dr. J. Treer, Bocskay-u. 9, Szeged.
Secretary: Dr. G. Kelemen, Reáltanoda-u. 9, Budapest.

Sociedad Rioplatense de Oto-Rhino-Laringología (Argentine Section)

President: Dr. Raul Becco, B. Mitre 1690, Buenos Aires, Argentina.
Secretary: Dr. Juan Manuel Tato, Santa Fé 1171, Buenos Aires, Argentina.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. H. Marshall Taylor, 111 W. Adams St., Jacksonville, Fla.
Secretary: Dr. Leroy A. Schall, 270 Commonwealth Ave., Boston.
Place: St. Louis. Time: May 15-19, 1939.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Harry S. Gradle, 58 E. Washington St., Chicago.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Washington, D. C. Time: Oct. 9-14, 1938.

American Bronchoscopic Society

President: Dr. John D. Kernan Jr., 120 E. 75th St., New York.
Secretary: Dr. Lyman Richards, 319 Longwood Ave., Boston.

American Laryngological Association

President: Dr. George B. Wood, 504 Physicians' Bldg., Philadelphia.
Secretary: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harold I. Lillie, Mayo Clinic, Rochester, Minn.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.

SECTIONS:

Eastern.—Chairman: Dr. Frank E. Kittredge, Masonic Temple, Nashua, N. H.
Southern.—Chairman: Dr. Francis E. LeJeune, Maison Blanche Bldg., New Orleans.
Middle.—Chairman: Dr. T. R. Gittins, Davidson Bldg., Sioux City, Iowa.
Western.—Chairman: Dr. Frederick G. Sprowl, Medical Arts Bldg., Spokane, Wash.

American Otological Society

President: Dr. Isidore Friesner, 36 E. 73d St., New York.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.

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* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.